

BYTE

THE WORLDWIDE COMPUTING AUTHORITY



Wireless PCs
Come of Age, Page 146

Create CD-ROMs on Your Desktop

**Low-Cost Recorders
Ignite CD Publishing**

PLUS

**BYTE Rates 17
Mac Accelerators**

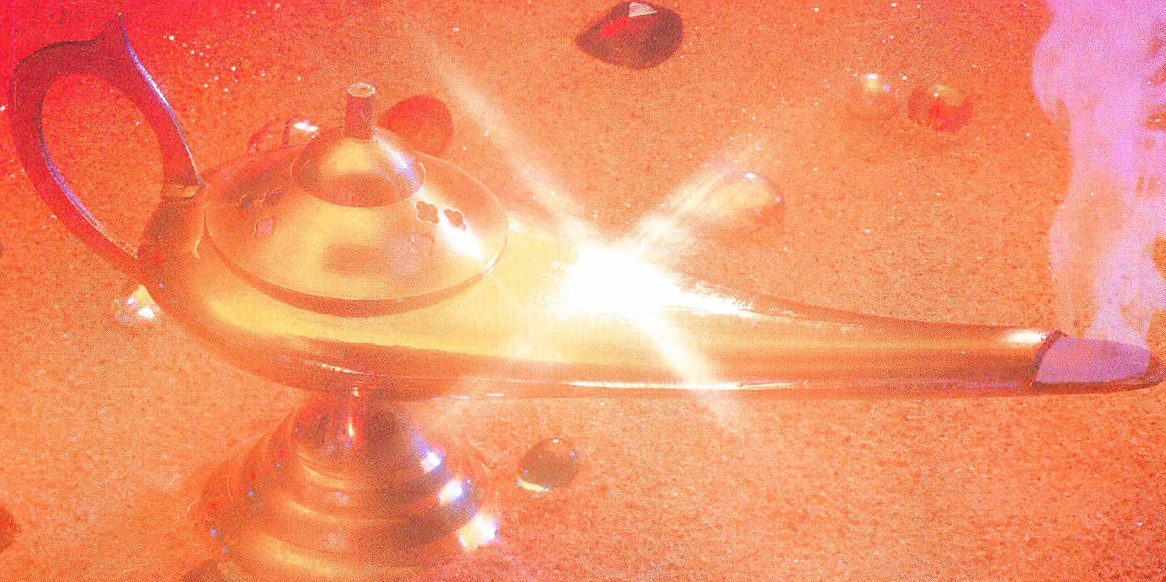
**Multi-Lingual Scholar:
63-Language Word Processor**

Pournelle:
**Windows for Workgroups
vs. LANtastic**



\$3.50 U.S.A. / \$4.50 IN CANADA
A McGraw-Hill Publication/0360-5280

What Do You
Wish
For In A PC?



Your Wish Is Our Co



"I wish I could get a great PC at a great price without sacrificing performance and features." Your wish is our command!

You'll be spellbound by Gateway's ferociously competitive prices on systems that are unequaled in powerful performance, impressive features and graceful integration of components. When readers and editors of the most popular PC magazines are asked which company delivers on its promises, their overwhelming response is Gateway 2000.



"Gateway has gone far beyond conventional ideas of price and performance ... it has created new rules that other PC makers will have to follow if they want to remain players."

— *PC Computing*, 1992 MVP Awards




"Gateway 2000 was the big 1992 Best Buy winner, sweeping not only the desktop awards as it did last year, but the newly expanded notebook categories as well ... Altogether, Gateway won five Best Buy awards this year, including Best

Overall System Vendor ... It's no surprise that Gateway is consistently the people's choice when it comes to systems.

— *Computer Shopper*, 1992 Readers' Best Buy Awards




Command!

 "I wish I could be sure I'm buying from a PC company that will provide excellent service and support - a company that will be around for me." Your wish is our command!

Twice in 1992, Gateway was honored for outstanding service. *PC World* readers ranked Gateway number one in service and support. And *PC Magazine* readers gave Gateway the best overall scores in the 1992 Service and Reliability Survey.

Just as important is our strength as a company. Warranties and assurances of lifetime technical support don't mean anything unless a company survives to honor them, which is a serious consideration in the shifting sands of today's PC marketplace.

Gateway is among the few financially robust companies in the industry. Our 1992 revenues exceeded \$1 billion and our earnings are among the strongest in the industry. The company is virtually debt-free. At a time when other companies have been forced to lay off employees, we added 300 people to our staff. You now have 1,800 friends in the business. Rest assured Gateway is your oasis that will never leave you high and dry. We'll be here for you!

 "I wish I could find the combination of features I need in a portable PC - at the right price." Your wish is our command!

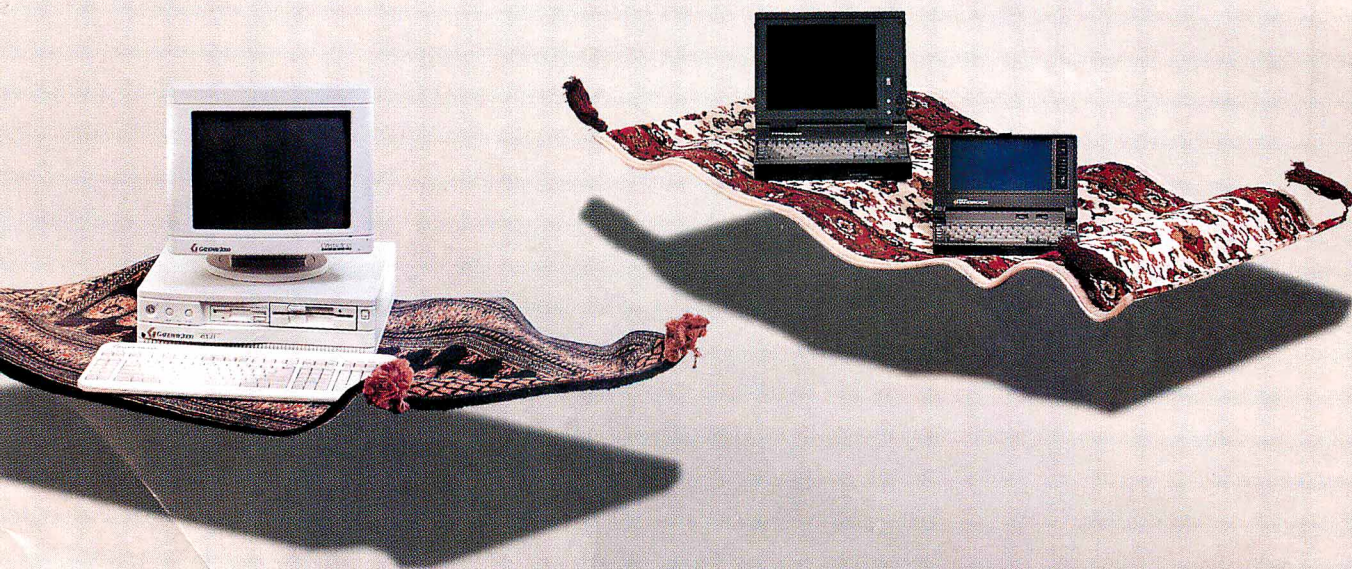
No matter what you need in a portable, you'll find it in one of our Nomad models or in the Gateway HandBook.™ Gateway customers selected Nomads as the winners in 386 and 486 notebook categories of *Computer Shopper's* 1992 Best Buy Awards.

"There are faster laptops, there are cheaper laptops, there are color laptops, but there is no better laptop ... Weighing in at only 5.6 pounds, the Nomad combines the powerful punch of a 25MHz i486DX with a working battery life of more than six hours. At long last, we have a laptop that can really go the distance when there's no power outlet in sight."

- *Computer Shopper*, 1992 Readers' Best Buy Awards

The Gateway 2000 HandBook was recognized by *Popular Science* magazine as one of the "Best of What's New" products of 1992, also received *BYTE* magazine's Award of Distinction.

PC Computing describes the HandBook as "an engineering marvel." *PC Week* agrees. "Gateway's HandBook is just about as small as a fully functional portable can be."



Our Caravan Of Extras.

Software Selections

Your every software need is our command. With mini desktop, desktop and tower systems that include "choice of application software," select one of the following applications, all latest versions:

- Microsoft® Excel for Windows™
- Microsoft Word for Windows™
- Microsoft Word and Bookshelf 92,® CD-ROM Edition
- Microsoft PowerPoint for Windows™
- Microsoft Project for Windows™
- The MS Entrepreneur Pack (Works,™ Publisher,™ Money,™ and games)
- Borland Paradox® or dBASE IV®
- The Windows Programmer Pack (MS Quick C,™ Visual Basic and more)
- Upgrade to Microsoft Office™ for \$175

Free Utilities

Cool Tools for DOS, a diagnostic and utilities package, comes with all Gateway desktop systems and includes:

- QA Plus™ from Diagsoft™
- Central Point® Anti-Virus, RAM Boost, Defrag and Emergency Disk

Microsoft Windows™ for Workgroups

Windows for Workgroups is ideal for e-mail, group scheduling and resource sharing, and includes an Ethernet adapter and software. Plus the hardware and software is factory-installed. You can see Windows for Workgroups running on Gateway systems in any of over 200 Egghead Software® stores in the U.S. Stop by for a demonstration!

■ \$159

Microsoft Windows Sound System™

This sound system designed especially for business use lets you speak to your PC for hands-free operation. It even reads numbers back to you for proofing. You can also embed audio messages in all your Windows OLE applications. Package includes soundboard, microphone, headset and software.

■ \$149

CD-ROM Kit

Includes interface card and everything you need to add CD-ROM to your PC. It's MPC-compliant and manufactured for us by Sony.®

■ \$225

The TelePath™ Fax/Modem

A 14,400bps modem, V.32bis, with 9,600bps fax capability. Includes WinFax Pro,™ Crosstalk™ for Windows, Qmodem™ and more.

■ \$195

CrystalScan™ 15-Inch Monitor

Non-interlaced 15-inch color monitor with flat, square screen – an upgrade option with the purchase of any Gateway 2000 desktop system.

■ \$100 (to upgrade from 14-inch 1024NI)

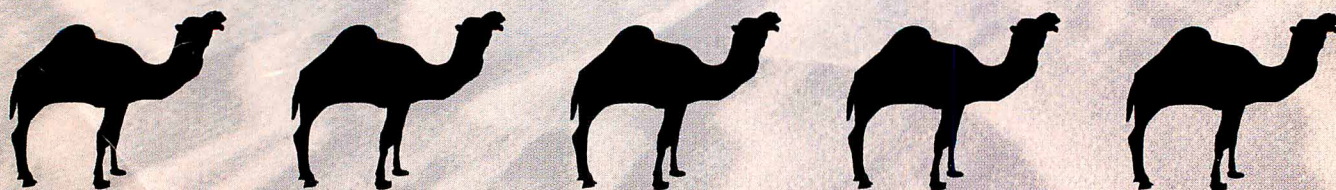
Panasonic Color-Capable Printer

Add color to your documents with this Panasonic KXP2123 24-pin dot matrix printer. Includes Adobe Type Manager.®

■ Printer, \$259; Color Option, \$50

Most Gateway peripherals are sold only with the purchase of a Gateway system.

For details on our complete line of components, peripherals and software, call direct to our special add-on components division at 800-252-3333.



Gateway 2000's Magical Values

DESKTOP SYSTEMS

3SX-25

- 25MHz 386SX Intel® Processor*
- 4MB RAM
- 5.25" & 3.5" Diskette Drives
- 80MB 17ms IDE Hard Drive
- Windows Accelerated Video with 1MB DRAM
- 14" Color CrystalScan™ 1024NI
- Mini Desktop Case
- 5 16-Bit ISA Slots
- 101-Key Keyboard
- MS-DOS,® Windows™ & Mouse
- Cool Tools for DOS
- MS Works for Windows™ 2.0

\$1295

4SX-25

- 25MHz 486SX Intel Processor*
- 4MB RAM
- 5.25" & 3.5" Diskette Drives
- 170MB 13ms IDE Hard Drive
- Local Bus IDE Interface
- Windows Accelerated Video with 1MB DRAM
- 14" Color CrystalScan 1024NI
- Mini Desktop Case
- 5 16-Bit ISA Slots
- 101-Key Keyboard
- MS-DOS, Windows & Mouse
- Cool Tools for DOS
- MS Works for Windows 2.0

\$1495

4SX-33

- 33MHz 486SX Intel Processor*
- 4MB RAM, 64K Cache
- 5.25" & 3.5" Diskette Drives
- 170MB 13ms IDE Hard Drive
- Local Bus IDE Interface
- Windows Accelerated Video with 1MB DRAM
- 14" Color CrystalScan 1024NI
- Mini Desktop Case
- 5 16-Bit ISA Slots
- 101-Key Keyboard
- MS-DOS, Windows & Mouse
- Cool Tools for DOS
- Choice of Application Software

\$1695

4DX-33

- 33MHz 486DX Intel Processor*
- 4MB RAM, 64K Cache
- 5.25" & 3.5" Diskette Drives
- 250MB 13ms IDE Hard Drive
- Local Bus IDE Interface
- Windows Accelerated Video with 1MB DRAM
- 14" Color CrystalScan 1024NI
- Mini Desktop Case
- 5 16-Bit ISA Slots
- 124-Key AnyKey™ Keyboa:
- MS-DOS, Windows & Mou
- Cool Tools for DOS
- Choice of Application Software

\$1995

4SX-33V

- 33MHz 486SX Intel Processor*
- 8MB RAM, 64K Cache
- 5.25" & 3.5" Diskette Drives
- 170MB 13ms IDE Hard Drive
- Local Bus IDE Interface
- VESA Local Bus ATI Ultra Pro with 1MB VRAM
- 15" Color CrystalScan 1572FS
- Desktop Case (Tower Upgrade)
- 8 16-Bit ISA Slots, 2 with 32-Bit VESA Local Bus
- 124-Key AnyKey Keyboard
- MS-DOS, Windows & Mouse
- Cool Tools for DOS
- Choice of Application Software

\$2195

4DX-33V

- 33MHz 486DX Intel Processor*
- 8MB RAM, 64K Cache
- 5.25" & 3.5" Diskette Drives
- 250MB 13ms IDE Hard Drive
- Local Bus IDE Interface
- VESA Local Bus ATI Ultra Pro with 1MB VRAM
- 15" Color CrystalScan 1572FS
- Desktop Case (Tower Upgrade)
- 8 16-Bit ISA Slots, 2 with 32-Bit VESA Local Bus
- 124-Key AnyKey Keyboard
- MS-DOS, Windows & Mouse
- Cool Tools for DOS
- Choice of Application Software

\$2495

4DX2-66V

- 66MHz 486DX2 Intel Processor*
- 8MB RAM, 64K Cache
- 5.25" & 3.5" Diskette Drives
- 340MB 13ms IDE Hard Drive
- Local Bus IDE Interface
- VESA Local Bus ATI Ultra Pro with 1MB VRAM
- 15" Color CrystalScan 1572FS
- Desktop Case (Tower Upgrade)
- 8 16-Bit ISA Slots, 2 with 32-Bit VESA Local Bus
- 124-Key AnyKey Keyboard
- MS-DOS, Windows & Mouse
- Cool Tools for DOS
- Choice of Application Software

\$2995

4DX2-66E

- 66MHz 486DX2 Intel Processor*
- 8MB RAM, 256K Cache
- 5.25" & 3.5" Diskette Drives
- 500MB 11ms SCSI Hard Drive
- 32-Bit EISA SCSI Controller
- Windows Accelerated Video with 1MB DRAM
- 14" Color CrystalScan 1024NI
- Tower Case
- 8 32-Bit EISA Slots
- 124-Key AnyKey Keyboard
- MS-DOS, Windows & Mouse
- Cool Tools for DOS
- Choice of Application Software

\$3795

PORTABLE SYSTEMS

HANDBOOK™

- 286-Class Performance
- 1MB RAM Upgradeable to 3MB
- 40MB Hard Drive
- Backlit 7.6" CGA Screen
- Size 5.9" x 9.75" x 1.4", 2.75 Lbs.
- 4.5-Hr. NiMH Battery & AC Pack
- Alkaline Battery Pack
- 1 Parallel/1 Serial Port
- 78-Key Keyboard
- MS-DOS 5.0, LapLink® XL, MS Works™ for DOS, Central Point® Desktop & Serial Download Cable
- Carrying Case

\$1295

NOMAD 425SXL

- 25MHz 486SXL Intel Processor*
- 4MB RAM
- 3.5" Diskette Drive
- 80MB IDE Hard Drive
- Backlit 10" VGA Screen, 64 Grays
- Simultaneous Video with 256K
- Size 8.5" x 11" x 1.8", 5.6 Lbs.
- 6-Hr. NiCad Battery & AC Pack
- 1 Parallel/1 Serial Port
- 79-Key Keyboard & FieldMouse™
- MS-DOS 5.0 and Windows 3.1
- MS Works for Windows 2.0

\$1995

NOMAD 425DXL

- 25MHz 486DXL Intel Processor*
- 4MB RAM
- 3.5" Diskette Drive
- 120MB IDE Hard Drive
- Backlit 10" VGA Screen, 64 Grays
- Simultaneous Video with 1MB
- Size 8.5" x 11" x 1.8", 5.6 Lbs.
- 6-Hr. NiCad Battery & AC Pack
- 1 Parallel/1 Serial Port
- 79-Key Keyboard & FieldMouse
- MS-DOS 5.0 and Windows 3.1
- MS Works for Windows 2.0

\$2695



*Contains an Intel386™ or Intel486™ microprocessor



8 0 0 - 5 2 3 - 2 0 0 0

610 Gateway Drive • P.O. Box 2000 • North Sioux City, SD 57049-2000 • 605-232-2000 • Fax 605-232-2023

Sales Hours: 7am-10pm Weekdays, 9am-4pm Saturdays (CT)

©1992 Gateway 2000, Inc. AnyKey, HandBook, FieldMouse, CrystalScan and TelePath are trademarks of Gateway 2000, Inc. The Intel Inside Logo is a trademark and Intel is a registered trademark of Intel Corporation. All other brands and product names are trademarks or registered trademarks of their respective companies. Prices and configurations are subject to change without notice. Prices do not include shipping.

Your wish

is our command at

Gateway 2000! We can grant you the three most universal PC wishes in the wink of an eye. As a fringe benefit, we won't limit you to three wishes here. Most anything your heart desires in computers (sorry, we can't grant wishes for romance or riches), you can get from Gateway.

That's because we built our business by listening to our customers' wishes and doing everything in our power to make their dreams come true. At Gateway, we believe you should be able to *have it all*: the latest technology, glittering performance, quality construction, enchanting service and the fairest prices in the land. All this from a financially healthy company that won't run dry and leave you stranded in the desert.

You don't have to settle for less. With Gateway 2000, you can have it all. Draw up your wish list and give us a call. We'll make some truly magical values materialize for you.

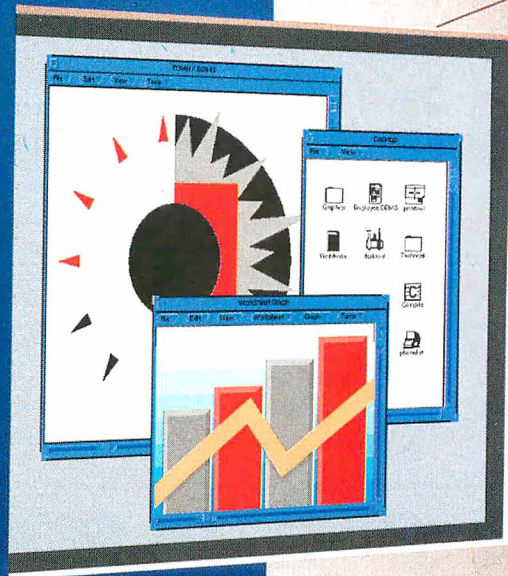


8 0 0 - 5 2 3 - 2 0 0 0

INTERACTIVE™ UNIX®
OPERATING SYSTEM



INTERACTIVE™ UNIX®
OPERATING SYSTEM



So Powerful It Can't Be A PC.

Transform Your PC With The INTERACTIVE UNIX System.

Unleash the 32-bit power in your PC with the INTERACTIVE™ UNIX® System from SunSoft. Charge through applications at record speeds. Use real-world multitasking and networking. Get on the path to a distributed computing future.

Just Say No To SCO.

Why? The INTERACTIVE UNIX System is easy to use, simple to administer, all at a great price.

*Open Systems Today** says the INTERACTIVE UNIX "system management...is easier to use and more comprehensive" than SCO™ and "is simply a masterpiece of good design."

Looking Glass Professional™ desktop manager makes the INTERACTIVE UNIX System easy enough for novices, yet powerful enough for experienced UNIX users. And the award winning Easy Windows makes setting up graphic environments infinitely simpler.

You can't afford *not* to take advantage of the already low cost of the INTERACTIVE UNIX System.

And SCO UNIX/XENIX® users can save an additional 50% by switching to the INTERACTIVE UNIX System today. That's something to say yes to.



Everything You Like About Your PC—And A Lot More.

INTERACTIVE UNIX System V/386 Release 3.2 supports hundreds of the most popular Intel-based platforms and peripherals. So getting started is fast, easy, and cost-effective.

Thousands of UNIX and XENIX applications are at your command. And our VP/ix package runs virtually all DOS software.

You get Lotus™, WordPerfect®, and Oracle®. You get SCO applications. You get it all.

See What Develops.

The INTERACTIVE UNIX System is the environment of choice for 80X86 application development. You get access to a full range of development tools including compilers, debuggers and libraries. And for graphical applications, the X11 INTERACTIVE environment is a revelation.

Partner With Power.

The INTERACTIVE UNIX System is a powerful business partner for companies who know something about power. Companies like BMW, Goodyear, Leica, and Dunlop to name a few. That power can be yours, too. All from SunSoft, the leading supplier of 32-bit UNIX system software.

Call today and save 50% on UNIX power that's so cost-effective, it can't be anything *but* a PC. 1-800-227-9227.

 **SunSoft**
A Sun Microsystems, Inc. Business

BYTE

February 1993 Volume 18, Number 2


COVER STORY

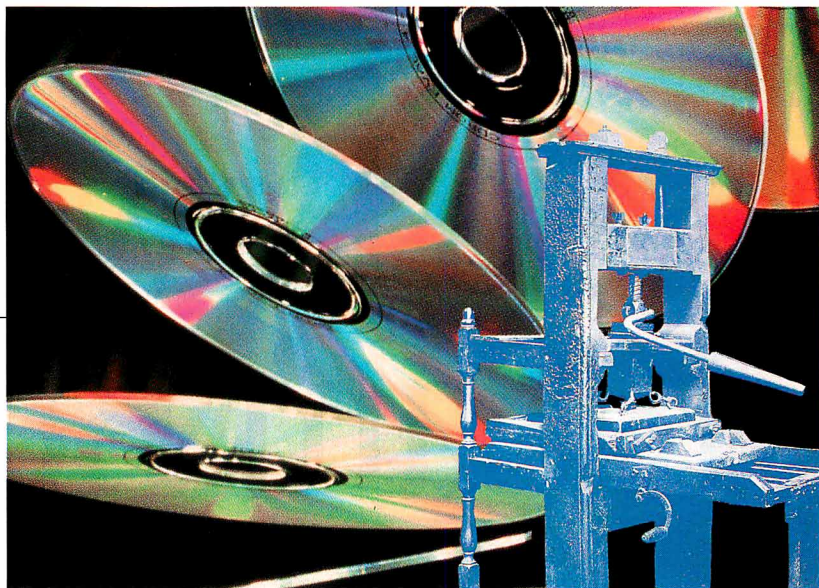
FEATURE

Start the Presses

PAGE 116

NEWS

- 32 MICROBYTES**
HP, DEC, and Sun unveil new high-powered workstations.
- 41 REPORT FROM LAS VEGAS**
Comdex: Bigger Than Ever
by Rich Malloy
Picking the best products at the show was even harder than usual.
- 47 REPORT FROM ITALY**
Computers Italian Style
by Andy Redfern
The Italians love stylish computers but crave innovation from abroad.
- 52 FIRST IMPRESSIONS**
Lotus Improv for Windows
by Kenneth M. Sheldon
A radical application comes to Windows.
- 54 FoxPro 2.5**, the cross-platform strategy begins to pay off
- VideoSpigot for Windows**, SuperMatch's video-capture board
- Falcon030**, Atari's PC with a DSP
-  **QMS 1725 Print System**, the latest 17-ppm screamer
- Freelance Graphics for Windows 2.0**, prepare presentations painlessly
- TyIN 2000**, a packed adapter card
- WordPerfect 5.2 for Windows**, an impressive upgrade
- 72 WHAT'S NEW**
Tektronix offers printers for workgroups, SunConnect extends LANs to global networks, and more.



FEATURES

- 116 Start the Presses** *by Jon Udell*
CD-ROM publishing comes to the desktop.
- AFFORDABLE CD-R DRIVES** *by Jon Udell and Howard Eglowstein*
- BUYING A CD-ROM DRIVE** *by Tom Halfhill*
- THE NEW BREED OF CD PLAYERS**
by Ed Perratore
- OPTICAL FLAVORS** *by Andy Reinhardt*
- 139 Is ITV Here to Stay?** *by Cary Lu*
Interactive TV's survival and prosperity are in question.



STATE OF THE ART

WIRELESS COMMUNICATIONS

- 146 Overview: Wireless Mobile Communications**
by John P. Mello Jr. and Peter Wayner
The ability to communicate anytime, from anywhere, is almost here.
- 159 Stretching the Ether**
by Peter Wayner
Technology expands the wireless spectrum.
- 169 Communications Get Personal**
by Bob Ryan
AT&T's Hobbit powers a new generation of personal communications devices.
- 177 Resource Guide: Plugging into Wireless**



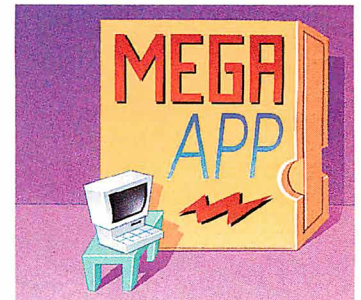
- 178 SOLUTIONS FOCUS**
Network Fax on Tap
by Raymond GA Côté, Steve Apiki, and Stan Wszola
 The BYTE Lab peers into 11 fax servers for PC, Mac, and Unix networks.
- 198 New Tricks for Slow Macs** ▷
by Rick Grehan
 The BYTE Lab tests 17 Mac accelerator boards.
- 205 The Second Premiere**
by Tom Yager
 Premiere 2.0 for the Mac offers QuickTime movie editing at its best.
- 207 A BASIC Breakthrough**
by Tom Yager
 Visual Basic for DOS makes powerful programs easy to write.
- 209 Forging a Business Tool: Three Fax Software Packages for Windows**
by Stan Miastkowski
 Three next-generation fax software packages bring new abilities to communications.
- 213 Complete Communications for Small Businesses**
by Stanford Diehl
 A new fax and voice-mail card from Prometheus takes on the upgraded Complete Communicator.
- 215 Stacking Up TCP/IP for Windows**
by Barry Nance
 Linking Windows clients with Unix hosts via TCP/IP stacks from Beame & Whiteside, Frontier Technologies, and NetManage.
- 219 Correspondence That Looks Good Globally**
by Birrell Walsh
 Multi-Lingual Scholar, a word processor for the global market.
- 221 Reviewer's Notebook: Retooling a Classic**
by Tom Thompson
 The BYTE Lab updates its Macintosh benchmarks.



HANDS ON

- 225 UNDER THE HOOD**
The Mac Goes to the Movies
by Andrew W. Davis and Joe Burke
 A detailed look at Apple's QuickTime architecture.
- 231 SOME ASSEMBLY REQUIRED**
Handling Input Events Using C++
by Randall A. Nagy
 Use the Event class to handle keyboard and mouse input across platforms.
- 235 SOFTWARE CORNER**
A Small Browser with Everything
by Barry Nance, Tom Thompson, and Ben Smith
 A powerful DOS browser, a faster Finder, and Perl-based recursive grep.
- 237 BEYOND DOS**
A New OS/2
by Mark J. Minasi
 IBM's ServicePak and the Professional Developer's Kit CD-ROM are dissected.
- 239 ASK BYTE**
 Adobe Type Manager conflicts, the Next as document manager, and more.

- 97 USER'S COLUMN**
LAN Wars
by Jerry Pournelle
 Windows for Workgroups battles LANtastic for domination at Chaos Manor.
- 222 BOOK AND CD-ROM REVIEWS**
Again the Swinging Gates
by Hugh Kenner, Dick Pountain, Jon Udell, and Raymond GA Côté
 Another look at Microsoft's leader, a controversial Windows book, how to program in Oberon, and more.
- 286 STOP BIT**
Software Gluttony
by Andy Nicholson
 It's time for programmers to rein in today's bloated, resource-hogging applications.



- 12 EDITORIAL**
CD-ROM: Now Is the Time
by Dennis Allen
- 20 LETTERS**
 Operating-system trends, OS/2 at a crossroads, digital photography, the ultimate workstation, and other issues.

READER SERVICE

- 284** Editorial Index by Company
280 Alphabetical Index to Advertisers
282 Index to Advertisers by Product Category
 Direct Link Cards: **176A, 280A**

BUYER'S GUIDE

- 243** Mail Order
 Hardware/Software Showcase
 Buyer's Mart

PROGRAM LISTINGS

From BIX: Join "listings/frombyte93" and select the appropriate subarea (i.e., "feb93"). From the UUNET: ftp to ftp.uu.net, log on as "anonymous," and enter your user ID as your password. Type "cd/published/byte" and type "DIR." Files appear in subdirectories arranged by month.

From the BYTE BBS at 1200-9600 bps: Dial (603) 924-9820 and follow the instructions at the prompt.

TWIN

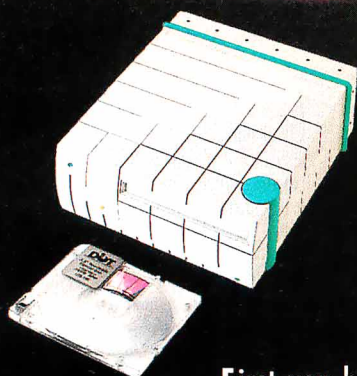
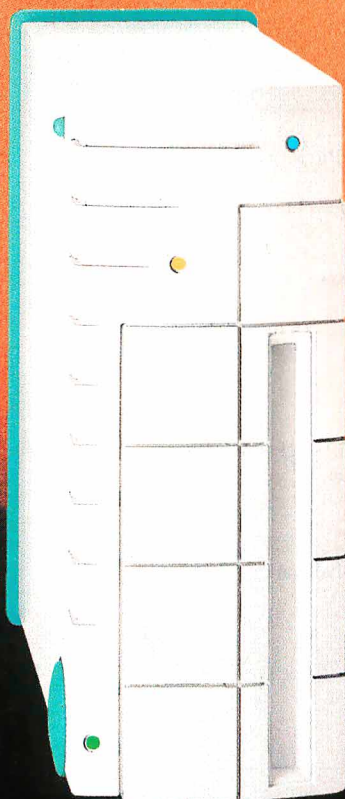
THE FIRST OPTICAL HARD DRIVE.

"It has a 19-millisecond access time and outperformed every other device we tested here. . ."

Stanley Wszola
Byte

"... the PMO-650 delivers unparalleled performance. . ."

John Quain
PC Magazine



TYPE: 3.5" OPTICAL
CAPACITY: 128 MB
SIZE: 6.9" (H) x 2.7" (W) x 8.3" (D)
WEIGHT: 4.11 LBS
MOUNTING: VERTICAL OR HORIZONTAL

First you bought a 40MB hard drive, then an 80MB, stepped up to a 150MB, made the move to a 300MB, and took out a loan to buy a 600MB. It never ends - until today.

Introducing the first line of optical drives that are lightning fast and have unlimited capacity. The PMO-130™ and PMO-650™ are the world's fastest optical drives with performance that rockets past most magnetic hard drives.

NSTL OPTICAL VS. HARD DISK				
Drive Tested	Pinnacle PMO-650™	Seagate® ST4766N 630MB	Fujitsu M2266SA 1.2GB	Maxtor® XT-8760SH 676MB
ELAPSED TIME IN SECONDS				
Xcopy 20MB Tree to Optical Drive	135.3	210.6	165.5	178.9
Xcopy 50MB Tree to Optical Drive	379.5	496.8	375.1	428.7
NATIONAL SOFTWARE TESTING LABORATORIES, Inc.				

NSTL OPTICAL VS. OPTICAL					
Drive Tested	Pinnacle PMO-650™	Sony® SMO-E502	Maxoptix Tahiti II	Hewlett-Packard Corsair™	Ricoh RO-5031E
ELAPSED TIME IN SECONDS					
Xcopy 20MB Tree to Optical Drive	135.3	506.5	440.6	198.1	477.5
Xcopy 50MB Tree to Optical Drive	379.5	1241.2	1047.9	492.7	1134.8
NATIONAL SOFTWARE TESTING LABORATORIES, Inc.					

Trademark Owners: PMO-130, PMO-650, OHD, Optical Hard Drive, and Pinnacle Micro are Trademarks of Pinnacle Micro, Inc. ©1992. Trademarks and registered marks to their respective owners. All test results performed by NSTL 8/92. Retail prices acquired from dealer survey 10/92.

19 Technology • Irvine, CA 92718 • Int'l (714) 727-3300 • Fax (714) 727-1913

PEAKS

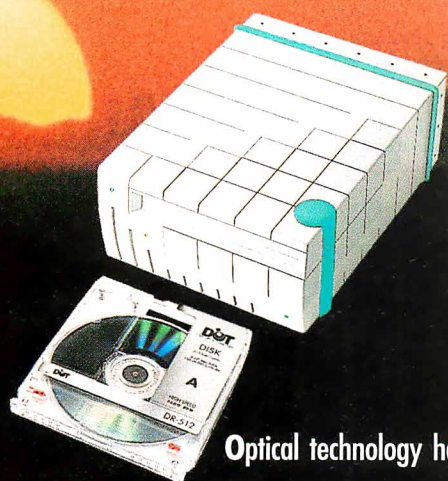
THE LAST DRIVE YOU'LL NEED.

"... the PMO-650 was a veritable rocket."

Christopher Stetson
PC Week

"The PMO-650 is the first rewritable optical drive we've ever tested that can get out and run neck and neck with hard disks"

Rex Farrance
PC World



TYPE: 5.25" OPTICAL
CAPACITY: 650 / 600 MB
SIZE: 7.3" (H) x 3.6" (W) x 10.0" (D)
WEIGHT: 7.4 LBS
MOUNTING: VERTICAL OR HORIZONTAL

Optical technology has many advantages-removability, reliability, infinite storage capacity, and a lower cost per megabyte over magnetic media. The PMO™ series are based on Pinnacle's own OHD™ (Optical Hard Drive) technology,

making Pinnacle the leader in performance and innovation. There is no higher source in the industry. The PMO-130™ and PMO-650™ are the Twin Peaks. Plug-n-play for PC and compatibles, PS/2, MAC, SUN, HP, DEC, and Silicon Graphics. It's more than a hard drive - It's optical!

COST PER MEGABYTE COMPARISON

Drive Type	Retail Price	2 Disks	5 Disks	10 Disks	50 Disks
PMO-650 Optical Drive (1 Disk)	\$ 4,394	\$ 4,593	\$ 5,190	\$ 6,185	\$ 14,145
Magnetic Hard Drive (650 MB)	\$ 3,594	\$ 6,793	\$ 16,390	\$ 32,385	\$ 160,345

(800) 553-7070

PINNACLE MICRO

THE OPTICAL STORAGE COMPANY®

INSIDE **BYTE**

BYTE Topic Index

This index helps you find articles that contain information on each of the listed topics. (The topic list changes each month.) Combined with the table of contents (page 4) and the Editorial Index by Company (page 284), you can identify articles by type, subject, title, author, or product discussed.

ACCELERATOR BOARDS 198	DEVELOPMENT 207	PHOTOGRAPHY 20	TRANSLATION 219
ADD-INS 54	FAXES/MODEMS 178, 209, 213	PORTABLE 146	UNIX 239
AT&T HOBBIT 169	GUIs 207	PRESENTATION GRAPHICS 205	UTILITIES 235
BASIC 207	INTERACTIVE TV 139	PRINTERS 54	VIDEO 198
BUSINESS 213	ITALY 47	PROGRAMMING 231, 237, 239, 286	VIRUSES 97
C++ 231	MACINTOSH 198, 205, 225	QUICKTIME 225	VOICE 213
CD-ROM 116	MOBILE COMPUTING 146	SERVERS 178	WINDOWS 52, 54, 97, 209, 215, 222
CHIPS 32, 169	MULTIMEDIA 205, 225	SHAREWARE 235	WIRELESS 146, 159, 177
COMMUNICATIONS 146, 159, 169, 177, 178, 209	NETWORKS 54, 97, 215, 222, 239	SPREADSHEETS 52	WORD PROCESSING 54, 219
DBMS 54	OS/2 237	SYSTEMS 41, 54	WORKSTATIONS 20, 32
DESKTOP 72	PERIPHERALS 72	TCP 215	XBASE 54
		TEXT 219	

GREAT THINGS COME IN SMALL PACKAGES

This powerful print server can tackle your biggest network printing problems

- Connects any parallel printer directly to your Ethernet LAN
- Fully Novell Netware 286 and 386 compatible
- Can attach to 8 file servers simultaneously
- Fast and easy to install
- Combines high-speed printing and exceptional printer control
- Supports encrypted passwords, forms, notify, cancel, and others
- Full one-year warranty and unlimited free technical support
- Made in the U.S.A.



Make the Rose Connection

ROSE
ELECTRONICS

10850 Wilcrest Drive • Houston, Texas 77099 • Phone (713) 933-7673 • Fax (713) 933-0044

1-800-333-9343



MX17F
MONITOR
EDITORS'
CHOICE
1992



VISION

GROWS

14" IN 1990. 15" IN 1991. 17" IN 1992.

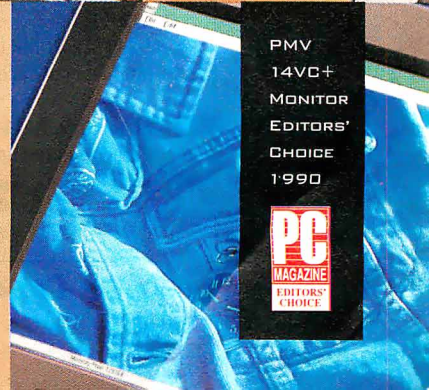
MAG Innovision wins the Editors' Choice year

after year after year, making us truly the growing monitor company of the nineties. THE LATEST ADDITION TO OUR FAMILY of winners is the sensational MX17F, whose "sharp image and competitive price make it a compelling choice." So do the MX17F's advanced features. We've combined the latest flat square tube technology with Invar Shadow Mask for distortion-free images and 30% more brightness. Dynamic focus circuitry keeps the whole screen razor-sharp. And non-interlaced resolution — up to

1280 x 1024 — assures the best picture possible. ALL IN ALL, this microprocessor-based, digitally controlled display is perfect for Windows®. Find out more. Contact us at 1-800-827-3998, or 4392 Corporate Center Drive, Los Alamitos, CA 90720. Tel: 714-827-3998. Fax: 714-827-5522.



MX15F
MONITOR
EDITORS'
CHOICE
1991



PMV
14VD+
MONITOR
EDITORS'
CHOICE
1990



© 1992, MAG Innovision. All rights reserved. MAG Innovision and its logo are trademarks of MAG Innovision. Windows is a registered trademark of Microsoft Corp. All other brand and product names are trademarks or registered trademarks of their respective owners.



Circle 154 on Inquiry Card (RESELLERS: 155).

Compudyne™. Latest Technology. Highest

eompudyne is the PC manufacturing and direct marketing arm of CompUSA™, the Computer SuperStore (NASDAQ symbol: CUSA)—inventors of big volume, deep discounting PC retailing, and the largest chain of computer super stores in the country. Compudyne manufactures top quality, fully-supported computers as available from only the largest PC manufacturers at prices typically found only at garage shop clone houses.

Result? We're already one of the largest direct PC companies in the country and guarantee that our prices are the lowest of any currently advertised.



Notebooks

Feast your eyes on "one of the best notebook values around" (Mobile Office 7/92), snugly packed into a slim, trim, 5.5 lb package (including battery). All include these nifty features:

- 11" x 8.5" x 1.6" (yes, only 1.6" thick!)
- Full 10", 64 grayscale brilliant VGA screen

- Internal 3 1/2" 1.44 MB floppy drive
- Built-in trackball saves carrying a mouse
- MS/DOS 5.0 and Microsoft® Windows 3.1 installed ready to run
- Lotus® Organizer Personal Information Manager™
- External SVGA monitor and keyboard support

- Expansion Station
- User-installable FAX modem and other options
- Full keyboard—dedicated 'page up/down', 'home' and 'end' keys
- Built-in serial (2) and parallel (1) ports
- FCC Class B certification

"The Compudyne SlimNote 4DX/33... (uses) a marvelous design that wraps a 33 MHz 486DX in a package just over 6 pounds. (This was one) of our favorites."

December 1992

PC Computing



Notebook	CPU	RAM (MBs)	HD (MBs)	Battery Life (Hrs)	Price
386SXL/25	386 SXL-25 MHz OPTIONAL 80387SX	2 STANDARD, 4 & 6 OPTIONS	80	3.5+	\$1,499 \$56/mo*
386SL/25	INTEL 80386SL-25 MHz, 64 K CPU CACHE ADVANCED SL POWER MGMT.	AS ABOVE	80	3.5+	\$1,499 \$56/mo*
486SX/33	INTEL 80486SX-33 MHZ, BUILT-IN 8K CPU CACHE	4 STANDARD, 8 & 20 OPTIONS	80	2.5+	\$1,999 \$74/mo*
486DX/33	INTEL 80486DX-33 MHZ, BUILT-IN 8K CPU CACHE	AS ABOVE	130	2.5+	\$2,499 \$93/mo*

ORDERING

- ▶ 1-800-932-COMP (2667)
- ▶ International callers dial: 1-214-702-0055
- ▶ 24 hour fax: 1-214-702-0300
- ▶ Corporate credit and volume terms available.



HOURS OF OPERATION

- ▶ 7am-10pm (CST) Mon.-Fri. and 9am-5pm (CST) Sat.

WARRANTIES

- ▶ 30-day, no questions asked, return policy.✓
- ▶ 1 year limited warranty.

SERVICE & SUPPORT

- ▶ Toll-free technical support
- ▶ On-site service for desktops† and overnight replacement for portables.
- ▶ Next-day shipping for most systems.

CBG & H
BEST BUY

486DX/33
Laptop Issue,
September 1992



We are to notebooks what Griselda of Skyland was to Pomeranians; the lightest.

PC
MAGAZINE

486DX/33

"Honorable mention"
August 1992

**DIAL
TO SAVE
DOLLARS**



1-800-932-COMP (2667)

†Within 100 miles of any Dow Jones Service Center. **Does not include Windows 3.1 or mouse. ✓ Must be returned "as new" in original package. Reprinted from "PC COMPUTING" December 1992 page 78. Copyright ©1992 Ziff Communications Company.

Quality. Lowest Prices. Guaranteed.

Desktops

Order one of our pre-configured systems or custom-configure your own, choosing from a myriad of options. All systems include...

- Microsoft® Windows 3.1 and MS/DOS 5.0
- Microsoft compatible serial mouse
- 200 watt power supply
- 101 AT-style keyboards
- FCC Class B certification



- Built in serial (2), parallel (1) and game (1) ports
- Artisoft's LANtastic® LAN
- 8 i/o board slots
- U/L listing



Get Horizontal...

Our standard desktop systems feature aesthetic yet rugged plastic-over-steel construction with "one screw" assembly

for quick easy upgrades. They support 3 externally accessible 5.25" drive bays and 2 internal 3.5" units.

Get Vertical...

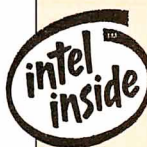
For those who prefer the aesthetics and footprint of a desktop tower or need the added drive capacity for file server applications, our mini tower offers an astonishing 6 drive capacity; 4 external plus 1 internal 5.25" and 1 internal 3.5" unit in a mere 8" x 16" desktop footprint for only \$100 more.

Options, Options, Options...

- Displays: Mono or color VGA; 1024 and 1280 interlaced or non-interlaced; 14" to 20"
- Hard Drives: 40; 80; 105; 120; 211; 483; 680 MBs or 1.2 GBs
- Internal CD-ROM (Incl. Groliers Encyclopedia, Toolworks, Reference Library and PC-SIG)
- Internal FAX/Modem: 9600 bps send/receive fax; 2400 bps modem; incl. WinFax and Quicklink Software.
- And many more!



If you can find a PC that meets or exceeds our equivalent specification, but is shipping at a lower advertised price, we'll match the price.



486SX/25
Best Buy,
December 1992



486SX/25
"Honorable mention"
October 13, 1992

You can also buy these neat products exclusively at
COMPUSA



Now Featuring VESA Local Bus Support!

Desktop	CPU	RAM (MBs)	HD (MBs)	FLOPPY	VIDEOBOARD/MONITOR	Price
386DX/33	INTEL 80386DX-33 MHz	2 STANDARD, 32 MAX	40	1.2 OR 1.44	16 BIT SVGA CARD/ 14" 640X480 VGA COLOR MONITOR	\$899 \$33/mo*
486SX/25	INTEL 80486SX-25 MHz WITH BUILT-IN 8K CPU CACHE	2 STANDARD, 32 MAX	80	AS ABOVE	16 BIT SVGA CARD/ 14" 800 X600 VGA COLOR MONITOR	\$999 \$37/mo*
486SX/33	INTEL 80486SX-33 MHz WITH BUILT-IN 8K CPU CACHE	4 STANDARD, 32 MAX	120	AS ABOVE	16 BIT SVGA CARD/ 14" 1024 X768 SVGA COLOR MONITOR	\$1199 \$44/mo*
486DX/33 CACHE	INTEL 80486DX-33 MHz 128K CPU CACHE	4 STANDARD, 32 MAX	120	1.2 & 1.44	16 BIT SVGA CARD TRUE COLOR WINDOWS ACCELERATOR CARD W/1 MB RAM/ 14" 1024 x 768 SVGA NON-INTERLACED COLOR MONITOR	\$1599 \$59/mo*
486DX/50 CACHE	INTEL 80486DX-50 MHz 128K CPU CACHE	4 STANDARD, 32 MAX	200	AS ABOVE	AS ABOVE	\$1999 \$74/mo*
486DX/66 CACHE	INTEL 80486DX2-66 MHz, 128K CPU CACHE, NEW DOUBLE CLOCK CPU	8 STANDARD, 32 MAX	340	AS ABOVE	AS ABOVE	\$2399 \$89/mo*

COMPU DYNE

THE LOWEST OF THE LOW PRICES. GUARANTEED.

Prices and specifications subject to change without notice. CompuDyne Direct, 15151 A Surveyor, Addison TX 75244.

BTE 0231



DENNIS
ALLEN

EDITORIAL

CD-ROM: Now Is THE TIME

If you don't have a CD-ROM drive, buy one. For that matter, you ought to buy a CD-ROM drive for every personal computer in your organization, because something big is happening. The ability to create your own CD-ROMs on the desktop is every bit as revolutionary as was the Gutenberg press.

Until now, electronic publishing has been the domain of large organizations that had the dedicated staff to place

information onto electronic media. Giant publishing houses have functioned like ancient monasteries, where countless scribes painstakingly penned information onto parchment. No one else had the wherewithal to do it.

Since the debut of CD-ROM, many folks have viewed electronic publishing with a jaundiced eye—a CD-ROM would be great, if only I could get *my* information on it. Now you can, with the arrival of CD-ROM recorders that sell for less than \$8000. In other words, for about the price of an office photocopier, you can have a machine that produces CD-ROMs containing thousands of pages of information.

Think of the reference and archive documents you could place at the fingertips of the people in your organization. Better still, think of the library of CD-ROMs that could contain documents particular to your field and your company. Now think of that library sitting on everyone's desk for quick and easy access. If you have remote offices, you can send them weekly updates of your structured databases on CD-ROM. Moreover, people who work in the field could use that CD-ROM on their portable computers.

We're not talking infoglut, either. I'll bet you can't find an attorney who wouldn't like to have a searchable CD-ROM containing all the briefs ever filed by his or her firm. Neither could you find a single, solitary accountant or finance wizard who wouldn't want a company's budgets and expense details on a single CD-ROM. You probably know programmers who would give up their subscription to the *Microsoft Systems Journal* for a CD-ROM that had every object and program module ever written by their company's development staff.

There are as many possibilities as there are megabytes of information. Until now, though, storing that information on a network has been costly, using exotic and expensive jukebox optical systems. Even if you provide the information on the network, remote offices often

can't get to that information.

Also consider the issue of dynamic information versus static. Not all information needs to be updated, and such static information shouldn't take up expensive writable media space. As for "live" information, not everyone needs update privileges. For these cases, it makes sense to publish on CD-ROM.

The only problem has been that CD-ROM mastering and duplicating costs have been high, especially if you needed only a few copies. Even then, there was no way to build a prototype CD-ROM with your information just to see how usable it might really be.

The advent of CD-ROM recorders for less than \$8000 presents wonderfully new opportunities. For such a reasonable amount, and about \$40 for the medium (a price that should drop rather quickly), your company can publish CD-ROMs on demand. The real strength of an organization lies in the ability of each individual to leverage the collective knowledge, and CD-ROM publishing is the tool that can allow that process to happen.

There is one catch, though. Most companies have not yet equipped all their systems with CD-ROM drives, and that has to be done. Fortunately, basic drives are available for as little as a couple of hundred dollars. Unfortunately, you will have to make some choices regarding CD-ROM formats, and our cover story this month ("Start the Presses," page 116) will help you with that.

Falling prices of systems should allow your 1993 budgets to cover that additional cost of CD-ROM drives in every new computer you buy. Keep in mind, too, that once you commit to CD-ROM drives for your company's internal information, you open the door to vast amounts of CD-ROM-based information from outside sources. In fact, you should expect the selection of CD-ROM material to grow significantly this year.

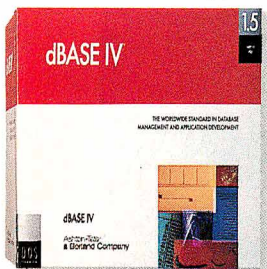
The point is that CD-ROM has come of age. It is unthinkable to not include CD-ROM in your strategic planning. And to the computer manufacturers who read this column, it is unconscionable to not include CD-ROM drives in new systems.

—Dennis Allen
Editor in Chief

NEW! VERSION 1.5

dBASE IV

Why it's smarter to go with #1



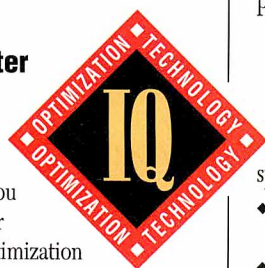
Now there's an easier-to-use, faster and more powerful dBASE®. It's packed with the features you've asked for most, making it

ever to use the world's standard PC database.

Working smarter is faster

With new dBASE IV®, you get the job done faster because you work smarter. Smarter because new **IQ!**™ optimization technology automatically selects the fastest method to retrieve your data. Smarter because you can create tables, forms, reports, queries and menus in record time—*without programming*.

Smarter because you get 40 different work areas for easier management of large applications. Plus mouse support for fingertip access to features, an enhanced RUN function to run popular DOS applications from within dBASE, and comprehensive multiuser capabilities. All of which means you maintain tight data integrity, more flexibility and more support than ever before.



Advanced design tools build applications faster

dBASE IV's easy-to-use Control Center comes complete with an innovative set of design tools, including report, form and label generators that help you create your applications quicker. And the Control Center's open architecture makes it easy to enhance or customize your own applications by incorporating any of the third-party add-on products available for dBASE.

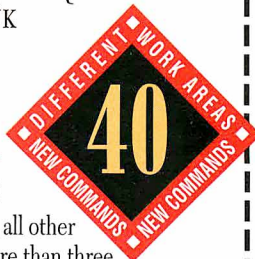
Faster applications development

The industry-standard dBASE language comes with a host of improvements that speed development:

- ♦ Integrated debugger and a built-in applications generator
- ♦ More than 40 new commands, functions and keywords—Template Language now included
- ♦ C language-like low-level file I/O
- ♦ IBM® SAA-compliant SQL
- ♦ Advanced BLANK support

Being the standard means world-class support

dBASE has outsold all other databases. With more than three million users and the world's largest community of custom application



developers and trainers, dBASE supports your data management needs in ways only the worldwide standard can. Now it's smarter than ever to go with #1.

Get more than \$250 in software FREE!

Now with every purchase of dBASE IV v1.5 we're giving away a Protection Pack that includes Central Point Software's Backup and Anti-Virus programs, *free** (retail value \$258). So you get the best database *and* the best data protection.

**See your dealer today. Or call
1-800-331-0877, ext. 6461
for more information.
In Canada call 1-800-461-3327**

YES! Send me my free Pro Pack Software!

Check DOS disk size required: ☐ 5 1/4" ☐ 3 1/2"

dBASE IV v1.5 Serial #: _____

Name: _____

Company: _____

Address: _____

(We cannot ship to P.O. Boxes.)

City/State/Province: _____

Zip/Postal Code: _____

Phone: () _____ FAX: () _____

COMPLETE this coupon, **ATTACH** a copy of your sales receipt (or a copy of purchase order and billing invoice) **AND ENCLOSE \$9.00 U.S.** for shipping and handling (check or money order payable to Borland International, Inc.).

Send to: Borland's Pro Pack Offer, P.O. Box 7243, San Francisco, California 94120-7243.

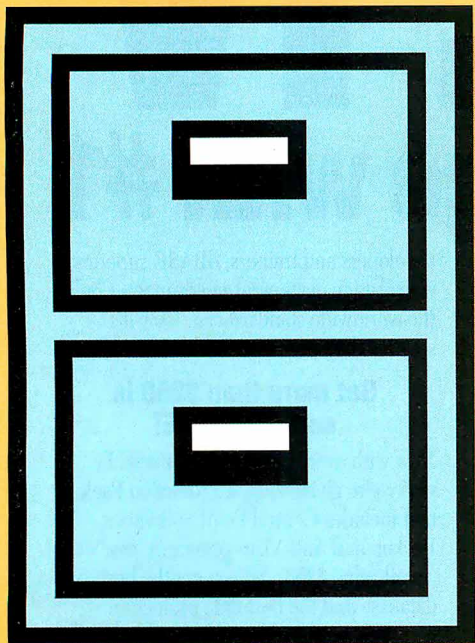
Offer good in U.S. and Canada only on dBASE IV v1.5 purchases between June 1 and September 30, 1992. Only original coupons will be accepted. No responsibility is assumed for lost, late, misdirected or destroyed mail. Please allow 4-6 weeks for delivery. Subject to all local, state and federal regulations. Void where prohibited. Offer not valid for Upgrades, Competitive Upgrades, LAN Packs, Volume Packs, or any other Borland promotion except dBASE IV v1.5 products with Borland's Passport promotion. Distributors and resellers not eligible to participate. Central Point is a registered trademark of Central Point Software.

B O R L A N D
Software Craftsmanship

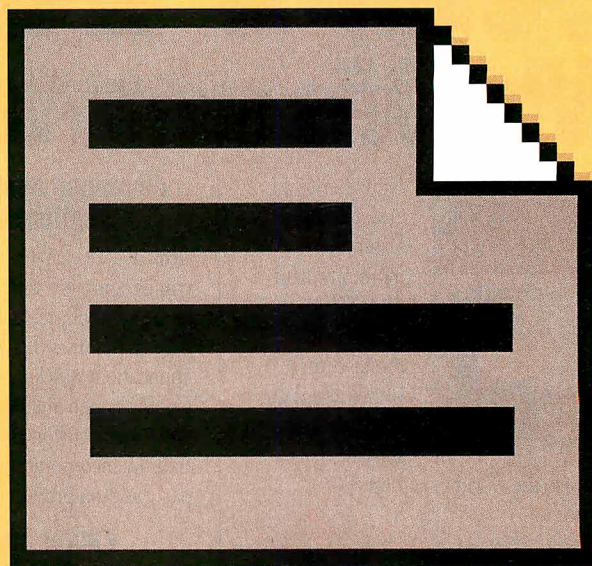
*Plus \$9.00 U.S. (shipping and handling). Copyright © 1992 Borland International, Inc. All rights reserved. dBASE and dBASE IV are registered trademarks of Borland International, Inc. BI 4227.2

Circle 65 on Inquiry Card (RESELLERS: 66).

What Do These Popular



Locate a file.



Open a document.

Everyone's getting into Windows.™

And 386-based computers continue to be the popular choice for value-conscious Windows users. The most demanding users—the people who know how to get the most for their money—are insisting on computers built around 40MHz Am386™ microprocessors from AMD.

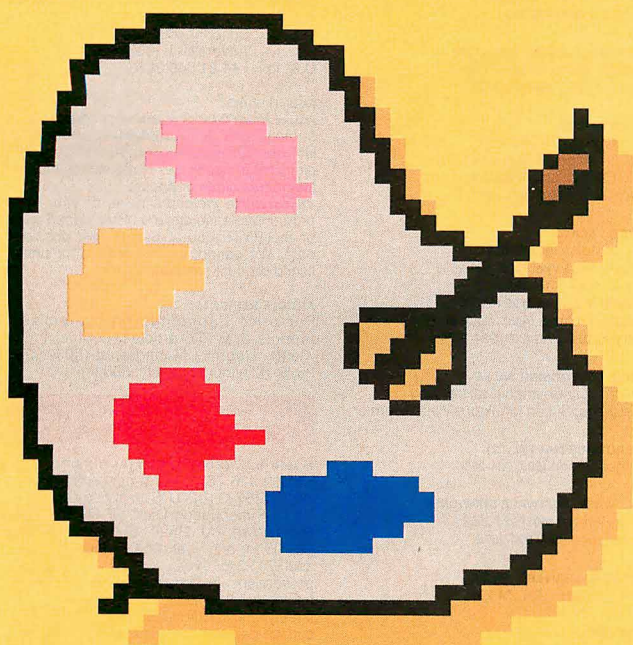


The 40MHz DXL-40 and SXL-40 are both available in low-cost PQFP packaging.

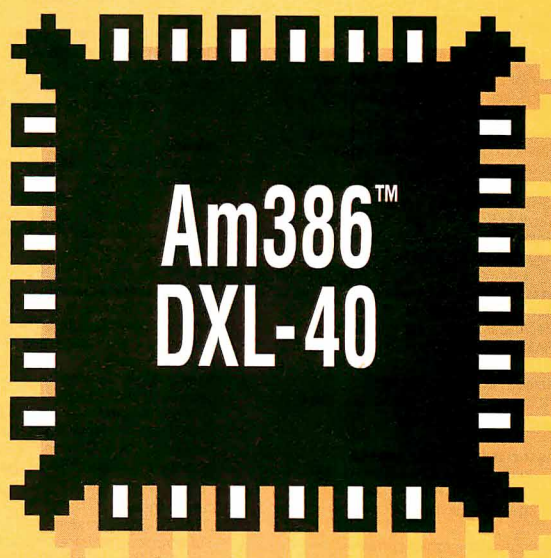
These are the fastest 386 CPUs made—up to 25% faster in-system than ordinary 386 microprocessors. So they'll run Windows applications the fast and efficient way they were meant to run.

Am386 microprocessors are available in volume. And with AMD's competitive prices, 40MHz 386 machines will come

Windows Icons Mean?



Create a graphic.



Get the most for the money.

with some mighty attractive price tags.

The Am386DXL and Am386SXL microprocessors are as space-efficient as they are cost-efficient because both are available with PQFP packaging. So holding the line on costs is even easier.

Call **1-800-222-9323** today for more information and ask for Literature Pack 16K.

Because the 40MHz 386 PC is a window of opportunity you can't afford to miss.



Advanced Micro Devices

Microprocessors For The Masses.SM

BYTE

EDITOR IN CHIEF
Dennis Allen

PUBLISHER
Ronald W. Evans

HOW TO CONTACT THE EDITORS

EXECUTIVE EDITORS

New York: Rich Malloy
Peterborough: Rich Friedman

MANAGING EDITOR
D. Barker

ASSISTANT MANAGING EDITOR
Lauren Stickler Thompson

NEWS

Peterborough:
Senior Editor: Dan Muse
News Editors, What's New: Martha Hicks, Carol Swartz
Microbytes: David L. Andrews
News Assistant: June Sheldon
San Mateo/West Coast:
Bureau Chief: Andrew Reinhardt
Senior Editor: Tom Halfhill
News Editor: Patrick Waurzyniak
Editorial Assistant: Barbara J. Caravello
Los Angeles:
Senior Editor: Gene Smarte
New York:
News Editor: Ed Perratore

BYTE LAB

Senior Editor & Director: Alan Joch
Technical Director: Rick Grehan
Technical Editors:
Stephen Apiki: systems, networking
Stanford Diehl: graphics software, add-ins, peripherals
Tom Yager: multimedia, Unix, operating systems, software development
Testing Editors/Engineers: Howard Eglowstein, Ben Smith, Stanley Wszola
Lab Assistant: Selinda Chiquoine

STATE OF THE ART/FEATURES

Senior Editor: Michael Nadeau
Technical Editors: Janet J. Barron, Anthony J. Lockwood, Robert M. Ryan

SENIOR TECHNICAL EDITORS

At Large: Tom Thompson, Jon Udell
Columns: Rob Mitchell

ASSOCIATE TECHNICAL EDITORS

Ellen Bingham, Susan Colwell, Jeff Edmonds, Tom Kevan, Cathy Kingery, Margaret A. Richard, Warren Williamson

SENIOR CONTRIBUTING EDITOR
Jerry Pournelle

CONTRIBUTING EDITORS
Hugh Kenner, Barry Nance

CONSULTING EDITORS

Roger C. Alford, Jonathan Amsterdam, Nicholas Baran, Raymond GA Côté, Don Crabb, Anne Fischer Lent, Laurence H. Loeb, Trevor Marshall, Dick Pountain, Wayne Rash Jr., Kenneth M. Sheldon, Jane Morrill Tazelaar, Ellen Ullman, Peter Wayner

EDITORIAL ASSISTANTS

Office Manager: Peggy Dunham
Assistants: Linda C. Ryan, Janet A. Young

DESIGN

Director: Nancy Rice
Associate Director: Joseph A. Gallagher
Designers: Jan Muller, Sharon Price

PRODUCTION AND FINANCE

Director: Claudia Flowers

PRODUCTION

Director: David M. Cohen
Production Manager: David R. Anderson
Advertising Graphics Manager: Susan Kingsbury
Editorial Graphics Manager: Virginia Reardon
Graphics Product Coordinators: Barbara Busenbark, Christa Patterson, Donna Sweeney, Lillian J. Wise
Advertising Services Manager: Linda Fluhr
Senior Advertising Services Representative: Lyda Clark
Advertising Services Representatives: Dale J. Christensen, Karen Cilley, Rod Holden
Quality Control Manager: Wai-Chiu Li
Operations Assistant: Lisa Jo Steiner

FINANCE

Senior Financial Analyst: Kenneth A. King
Financial Analyst: Kathleen Deguise
Data Processing Coordinator: Diane Henry
Billings Coordinator: JoAnn Walter
Production Assistant/Purchaser: Agnes Perry

MARKETING AND PLANNING

Director: L. Bradley Browne
Administrative Assistant: Carol Cochran
Marketing Communications Manager: Pamela Petrakos
Marketing Art Director: Stephanie Warnesky
Market Research Manager: Julie Perron
Copyrights Manager: Faith Kluntz
Reader Service: Cynthia Sands
Marketing Assistant: Carol Sanchioni

CIRCULATION

Director: Glyn Standen
Subscriptions Manager: Paul Ruess
Assistant Manager: Pam Wilder
Subscriptions Assistant: Christine Tourgee
Newsstand Manager: Vicki Weston
Assistant Manager: Karen Desroches
Back Issues: Louise Menegus
Direct Accounts Coordinator: Ellen Dunbar

Publisher's Assistant: Donna Nordlund

ADVERTISING SALES

National Sales Manager:
Jennifer L. Bartel (214) 701-8496

NEW ENGLAND

Patricia Payne (603) 924-2654

EAST COAST

Kim Norris (212) 512-2645
Jonathan Sawyer (603) 924-2665

SOUTHEAST

Mary Ann Goulding (404) 843-4782
Barry Echavarria (603) 924-2574

MIDWEST

Kurt Kelley (312) 616-3328
Ed Ware (603) 924-2664

SOUTHWEST, ROCKY MOUNTAIN

Jennifer Walker (214) 701-8496
Larry Levine (603) 924-2637

SOUTH PACIFIC

Beth Dudas (714) 753-8140
Joseph Mabe (603) 924-2662
Alan El Faye (213) 484-5243
Larry Levine (603) 924-2637

NORTH PACIFIC

Bill McAfee (408) 879-0381
Jonathan Sawyer (603) 924-2665
Roy J. Kops (415) 954-9728
Joseph Mabe (603) 924-2662
Barbara Holmes (408) 879-0381
Barry Echavarria (603) 924-2574

INSIDE ADVERTISING SALES

Director: Liz Coymann (603) 924-2518
Assistants: Susan Monkton, Vivian Bernier

THE BUYER'S MART (1 x 2)

Margot Gnade (603) 924-2656

HARDWARE/SOFTWARE SHOWCASE

Ellen Perham (603) 924-2598
Mark Stone (603) 924-2695

REGIONAL & BUYER'S GUIDE

Brian Higgins (603) 924-2651

BYTE DECK

Brad Dixon (603) 924-2596

EURO-DECK

James Bail (603) 924-2533

INTERNATIONAL ADVERTISING SALES STAFF

See listing on page 281.

PERSONNEL

Human Resources Administrator:
Patricia Burke
Assistant: Fran Wozniak
Receptionist: Beverly Goss

We welcome your questions, comments, complaints, kudos, and submissions.

MAIN OFFICE: One Phoenix Mill Lane, Peterborough, NH 03458, (603) 924-9281.
San Mateo: 1900 O'Farrell St. #200, San Mateo, CA 94403, (415) 513-6800.

Los Angeles: 15635 Alton Pkwy., Suite 290, Irvine, CA 92718, (714) 753-8140.
New York: 1221 Avenue of the Americas, New York, NY 10020, (212) 512-3175.

U.K./EUROPE: Wimbledon Bridge House, One Hartfield Rd., Wimbledon, London SW19 3RU, England, +44 81 543 1234.

ELECTRONIC MAIL: On BIX, send to "editors." All BYTE editors and columnists also have individual mailboxes on BIX for easy access.

MCI: 250-0135 BYTE Magazine. Many editors also have individual MCI addresses in their own name.

OTHERS: Many editors also are reachable through unnet, AppleLink, CompuServe, and numerous other services.

U.S. fax: Editorial: (603) 924-2550
Advertising: (603) 924-7507
U.K. fax: +44 81 540 3833

SUBMISSIONS:

Authors: We welcome article proposals and submissions. Unacceptable manuscripts will be returned if accompanied by sufficient return postage. Not responsible for lost manuscripts or photos.

Vendors: We welcome news of your new products; please call the News department or the BYTE Lab at the earliest possible date. We cannot be responsible for unsolicited product samples.

ARTICLE REPRINTS:

For price quotations on customized reprints of BYTE articles, contact Faith Kluntz, Reprints Manager, at (603) 924-2525. (Minimum quantity: 500.)

SUBSCRIPTION CUSTOMER SERVICE

Inside U.S. (800) 232-BYTE; outside U.S. +1 609 426 7676. For a new subscription, (800) 257-9402 U.S. only, or write to BYTE Subscription Dept., P.O. Box 555, Hightstown, NJ 08520. Subscriptions are \$29.95 for one year, \$54.95 for two years, and \$74.95 for three years in the U.S. and its possessions. In Canada and Mexico, \$34.95 for one year, \$64.95 for two years, \$87.95 for three years. In Europe, £29 (U.S. \$50) for fast surface delivery, £41 (U.S. \$70) for air delivery. Non-European countries U.S. \$50 for surface mail, or U.S. \$75 for air mail. Single copy price is \$3.50 in the U.S. and its possessions, \$4.50 in Canada. Foreign subscriptions and sales should be remitted in U.S. funds drawn on a U.S. bank. Please allow six to eight weeks for delivery of first issue.

PHOTOCOPY PERMISSION:

Where necessary, permission is granted by the copyright owner for those registered with the Copyright Clearance Center (CCC), 27 Congress St., Salem, MA 01970, to photocopy any article herein for personal or internal reference use only for the flat fee of \$1.50 per copy of the article or any part thereof. Correspondence and payment should be sent directly to the CCC, 27 Congress St., Salem, MA 01970. Specify ISSN 0360-5280, \$1.50. Copying done for other than personal or internal reference use without the permission of McGraw-Hill, Inc., is prohibited. Requests for special permission or bulk orders should be addressed to Faith Kluntz, Copyrights Manager, (603) 924-2525. BYTE is available in microform from University Microfilms International, 300 North Zeeb Rd., Dept. PR, Ann Arbor, MI 48106 or 18 Bedford Row, Dept. PR, London, WC1R 4EJ, U.K.

Copyright © 1993 by McGraw-Hill, Inc. All rights reserved. BYTE and BIX are registered trademarks of McGraw-Hill, Inc. Trademark registered in the United States Patent and Trademark Office.



Member Audit Bureau of Circulation



INTERACTIVE ON-LINE SERVICE

PRODUCT MANAGER
Kip Bryan

DIRECTOR OF COMPUTER-RELATED SERVICES
Stephen M. Laliberte

MEMBER SERVICES MANAGER
Kevin Plankey

EXCHANGE EDITORS

Amiga Exchange: Joanne Dow
Entertainment and Leisure Exchange: Rich Taylor
IBM Exchange: Barry Nance
Programmers Exchange: Bill Nicholls
Professionals Exchange: David Reed
Tojerry Exchange: Jerry Pournelle
WIX Exchange: Karen Kenworthy
Writers Exchange: Wayne Rash Jr.

BIX, owned and operated by General Videotex Corporation, is a worldwide, low-cost, on-line information service featuring industry news, downloadable software, powerful electronic mail, previews of upcoming BYTE articles, the full text of published issues of BYTE, and source and/or executable code for BYTE benchmarks and noncommercial software mentioned in feature articles. BIX also offers unmatched "conferences" on virtually every computer-related topic imaginable, where you can share information with thousands of other computer pros. To subscribe via modem, set your communications software to full duplex, 7 bits, even parity, 1 stop bit, and then call (800) 695-4882 or (617) 491-5410, or make a data call to our Tymnet address: 310690157800. Then hit the Enter/Return key and enter "BIX" when asked to log in; then enter "BIX.VILLE" when asked for a name. For current fees and more information, call (800) 695-4775 or (617) 354-4137 on voice phone; fax: (617) 491-6642; Internet: bix@genvid.com.

OFFICES OF MCGRAW-HILL, INC.:

Chairman, President, and Chief Executive Officer: Joseph L. Dionne; *Executive Vice President, General Counsel, and Secretary:* Robert N. Landes; *Executive Vice President:* Harold W. McGraw III; *Executive Vice President and Chief Financial Officer:* Robert J. Bahash; *Senior Vice President, Treasury Operations:* Frank D. Penglase; *Executive Vice President, Publication Services:* Norbert Schumacher.

Founder: James H. McGraw (1860-1948).

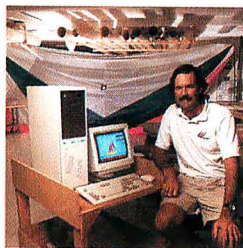
Winning With ALR Since 1987

FOR OVER FIVE YEARS, 1992 OLYMPIC GOLD MEDAL WINNER MARK REYNOLDS has relied on ALR computers to provide him with a competitive edge in the world of yachting. From the legendary FlexCache 25386 (the first computer to beat IBM and Compaq for PC Magazine's "Technical Excellence" award), to the best-selling BusinessVEISA, ALR has always delivered the latest in technology at an unbeatable price. Now, with the ALR PROVEISA, this winning tradition continues...



INTRODUCING THE ALR PROVEISA

Utilizing ALR's fastest i486DXTM and i486DX2TM CPUs, the ALR PROVEISATM has the power to breeze through today's most advanced applications. Built-in SuperVGA graphics let Mark view his latest sail designs quickly and clearly, while a 32-bit EISA bus provides the ultimate in PC data throughput.



And wait until you see what this system can do in a networking environment. Utilizing standard IDE drives, the ALR PROVEISA's available MULTUSTM "multi-seek" controller delivers better performance than expensive SCSI subsystems.* Five levels of system security protect valuable network data from tampering. And let's not forget about expandability -- the ALR PROVEISA offers ten EISA expansion slots, twelve drive bays, and room for up to 256-MB of memory.

Of course, the ALR PROVEISA's most unique feature is its upgrade path to dual processing. When you need even more performance, you can simply plug in a second i486 processor. Imagine having the power of two 66-MHz i486DX2 processors at your fingertips. Now that's world class speed!



To become a part of the winning ALR tradition, call:

1-800-444-4ALR

ALR[®]
Advanced Logic Research, Inc.

9401 Jeronimo Irvine, CA 92718
(714) 581-6770 FAX: (714) 581-9240
ALR Canada Ltd.: 800-465-5979
ALR U.K. Ltd.: 44-635-521922
ALR Deutschland GmbH: 49 69 33 38 11
ALR International (Singapore): 65-742 0866

*Optional larger secondary read/write back cache.
*Requires multiple IDE disk drives and a multithreaded operating system such as Novell[®] NetWare[™].

SYSTEMPRO[™] Compatible
Upgradeable
486DX
256KB/512KB*/1MB* Cache
32-bit EISA
Dual-Processor Ready
4-MB RAM
\$2,495

Available nationwide at these locations:

ComputerLand
Business to Business. PC's for people.

Connecting Point[™] **COMPUTER CENTERS**

ENTRE

TCBC

ALR Power Partner Resellers

Prices and configurations subject to change without notice. Systems shown with optional equipment. Verify exact specifications with ALR. Prices based on U.S. Dollars. ALR is a registered trademark of Advanced Logic Research, Inc. All other brand and product names are trademarks or registered trademarks of their respective owners. Intel Inside is a trademark of Intel Corp. *In order to take full advantage of the ALR MULTUS Controller multiple drives and multitasking operating systems such as Novell[®] NetWare are necessary. ©1992 by Advanced Logic Research, Inc.

Circle 196 on Inquiry Card (RESELLERS: 197).

**A highly placed engineer reveals his
technical assessment of the new
\$7,995, 59 MIPS, accelerated graphics,
eye-popping SPARCstation LX.**



©1992 Sun Microsystems, Inc. Sun, Sun Microsystems, the Sun logo, and PC-NFS are trademarks or registered trademarks of Sun Microsystems, Inc. All SPARC trademarks, including the SCD Compliant logo, are trademarks or registered trademarks of SPARC International, Inc. SPARCstation is licensed exclusively to Sun Microsystems, Inc. Products bearing SPARC trademarks are based upon an architecture developed by Sun Microsystems, Inc. All other products or service names mentioned herein are trademarks or registered trademarks of their respective owners.

"Can I keep it?"



To more than 650,000 people around the world a Sun™ workstation on their desk has become a way of life, a must.

Let us present the latest addition, SPARCstation™ LX. A graphics workstation that will take you screaming through your applications. Whether you work with CAD, AEC, CASE, design automation or document processing, imaging and office automation, SPARCstation LX is for you.

You can look at the LX in two different ways.

Just put on your numbers hat and you'll see 50 MHz, 59 MIPS, 64-bit memory bus, 10Mb/sec I/O, and so forth.

Or just sit down, load your favorite application, and you might not want to leave your desk.

Because the 8-bit accelerated graphics will make you use the full extent of your software, like interactively manipulating 2-D and 3-D wire-frame models.



And the built-in ISDN lets you share documents that combine text, graphics, images, audio, and video with anyone, anywhere. All with an intuitive graphical user interface called OPEN LOOK®.

You can even create powerful workgroups of SPARCstation LXs and existing PCs with Sun's PC-NFS® technology.

Any way you look at it, chances are this remarkable machine will end up staying on your desk.

Just call 1-800-426-5321, ext. 520 for more information or a demo. It's worth your time.



Sun Microsystems Computer Corporation
A Sun Microsystems, Inc. Business

Circle 135 on Inquiry Card.

LETTERS

Operating Systems in Depth

Regarding the October 1992 State of the Art section on operating systems, I am slightly confused as to why the authors keep comparing IBM's OS/2 to Microsoft's Windows NT. Windows NT is not aimed at the average computer user but toward high-end servers. OS/2, on the other hand, is aimed at the average user.

Johan Hellman
Stockholm, Sweden

In "OS/2 at the Crossroads" (October 1992), Mark Minasi says OS/2 2.0 is doing "in a word, badly." Elsewhere in that issue, Steve Mastrianni says, "Interest in OS/2 2.0 is growing by leaps and bounds" ("OS/2 2.0 Programming Tools Arrive—Finally"), and "[tool] vendors, noting the overwhelming response to OS/2 2.0, have announced products or plan to release products...." It's great to see that BYTE permits differing opinions.

Then in the State of the Art Resource Guide, which lists companies that have announced support for OS/2 2.0, Microsoft is listed. Is this a test to see if we're paying attention?

Bill Zinsmeyer
CompuServe address: 70324.64

Mark Minasi's "OS/2 at the Crossroads" is the first article I've found that accurately reflects the feel and experience of using OS/2 2.0. Other articles have reflected the authors' newness to OS/2 2.0's Workplace Shell or have used Windows as the standard by which to judge OS/2 2.0.

Keep up the reporting on OS/2.

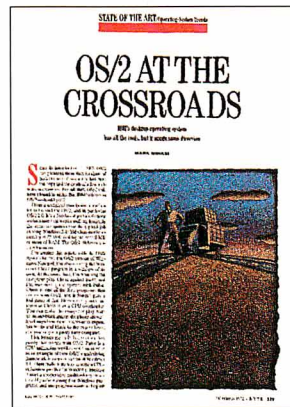
Dave Werner
Hong Kong

In the Resource Guide to the October 1992 State of the Art section on operating-system trends, The Periscope Co., which sells Periscope/32 for OS/2, is incorrectly listed in the Windows NT section. We should be in the OS/2 2.0 section.

Also, in "OS/2 2.0 Programming Tools Arrive—Finally," Steve Mastrianni says he doubts that you'll need more debugging tools than the ones IBM provides. The IBM kernel debugger is somewhat useful, but it has no source-level support and very limited symbolic support. In addition, it is hard to use and has a TTY-type serial interface. Periscope/32 for OS/2 supports full-screen source-level and symbolic debugging, and it has a user-friendly interface.

Dan Navarra
Director of Sales and Marketing
The Periscope Co., Inc.
Atlanta, GA

WE WANT TO HEAR FROM YOU. Address correspondence to Letters Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458, send BIXmail c/o "editors," or send Internet Mail to letters@bytepb.byte.com. Letters may be edited.



Digital Photography

The article "Smile for the Computer" (November 1992) was informative but missed one important application for digital photography.

I produce training materials, often on technically demanding topics such as advanced manufacturing equipment. Using Digital Vision's ComputerEyes/RT board, along with a standard VHS video signal, I capture images. I import a bit-mapped image into a vector-based illustrating package, such as Micrografx Designer, and use it as a template to overlay

a line drawing of the image. I then add text, fills, shading, and gradients as needed and delete the bit map.

This technique allows for the development of very accurate drawings of complicated subject matter quickly and without a tremendous amount of artistic interpretation. It also produces better results on low-end printers than if I used the bit maps directly. And the file sizes of the line drawings are much smaller than the bit maps they replace.

James Barfield
St. Ann, MO

A20 Revisited

Charles Bretana Jr.'s letter "A20 Issues" (November 1992), which responds to Mark J. Minasi's "Exorcising the A20 Poltergeist" (August 1992), contains a substantial error. The 386SX truly has only 24 address lines. Bretana's comment that the 386 extended mode requires access to a 4-GB address space confuses virtual memory with physical memory.

Andrew Klossner
Wilsonville, OR

You're right, but Bretana brings up an interesting point. Unfortunately, my response didn't make it into the November 1992 issue. Briefly, the internal memory registers on the 386 family are 32 bits wide, enabling the 386SL and 386SX to use the 386 protected mode on which Bretana originally commented. However, Intel wanted the 386SL and 386SX to displace the 286, so those chips have only 24 physical address lines. From a hardware point of view, there are 24 address lines; from a software point of view, there are 32.—Mark J. Minasi

The Ultimate Workstation

I was disappointed by your choice of an entry-level Nextstation in "Stalking the Ultimate Workstation" (November 1992). Considering the relative prices of other machines in the test, a Nextstation Turbo Color (with a 33-MHz 68030 CPU, 16 MB of RAM, a 400-MB hard drive, and a 21-inch color display) would have been a more telling comparison. Such a system sells for under \$11,000 and would have fared better in the benchmarks.

Ben VonZastrow
Oakland, CA

Break 640K *nine* ways with Vermont Views Plus!



Create the ultimate user-interface for your multi-megabyte DOS application—no matter which C compiler and DOS extender you use. Vermont Views Plus now supports all **nine** popular DOS extenders—and we're still counting!

640k barrier shattered!

The 640k barrier is gone at last! And Vermont Views Plus is here to give you the interface power you need to exploit the potential of the huge memory spaces now freely available.

Vermont Views Plus will help you create user-interfaces with the convenience and power of GUI interfaces, but with the speed, compactness and portability possible only with character-based interfaces.

Vermont Views Plus combines a powerful, menu-driven interface designer with a C library of over 600+ functions. You get the convenience of a fourth generation language with the power, flexibility, and blinding execution speed of native C code.

Vermont Views Plus for DOS includes full, documented source code for all libraries.

Put graphics to work

With all the memory available, there is every reason to enhance your text-mode applications with graphic displays. Vermont Views Plus can transparently translate all

text-mode menus, forms, and other screen displays into DOS-extended graphics modes. You can easily add charts, graphs, pictures, and other images using one of the popular third-party graphics libraries.

Vermont Views Plus support

DOS Extender	286	386/486
Borland C++ 3.1	✓	
Watcom C9.0/386		✓
Intel 386/486 C		✓
Phar Lap	✓	✓
Rational Systems	✓	✓
Ergo	✓	✓

The ultimate DBMS interface!

Vermont Views Plus is the ultimate interface tool for sophisticated database applications. Use it with any DBMS that has a C-language interface (including Oracle, Informix, Ingres, Sybase, db_VISTA, and c-tree).

You'll find it a snap to create branching data-entry forms with memo fields, scrollable regions, choice lists, and context-sensitive help. Build prototypes almost instantly. Easily extend the prototype into the final application. Slash your total development time!

The universal solution

Any interface you create with Vermont Views can be ported easily among DOS, OS/2, UNIX, POSIX, QNX, and VMS. UNIX versions include encrypted source code, so you can port your applications among machine architectures without further cost. **Never any royalties or runtime fees.**

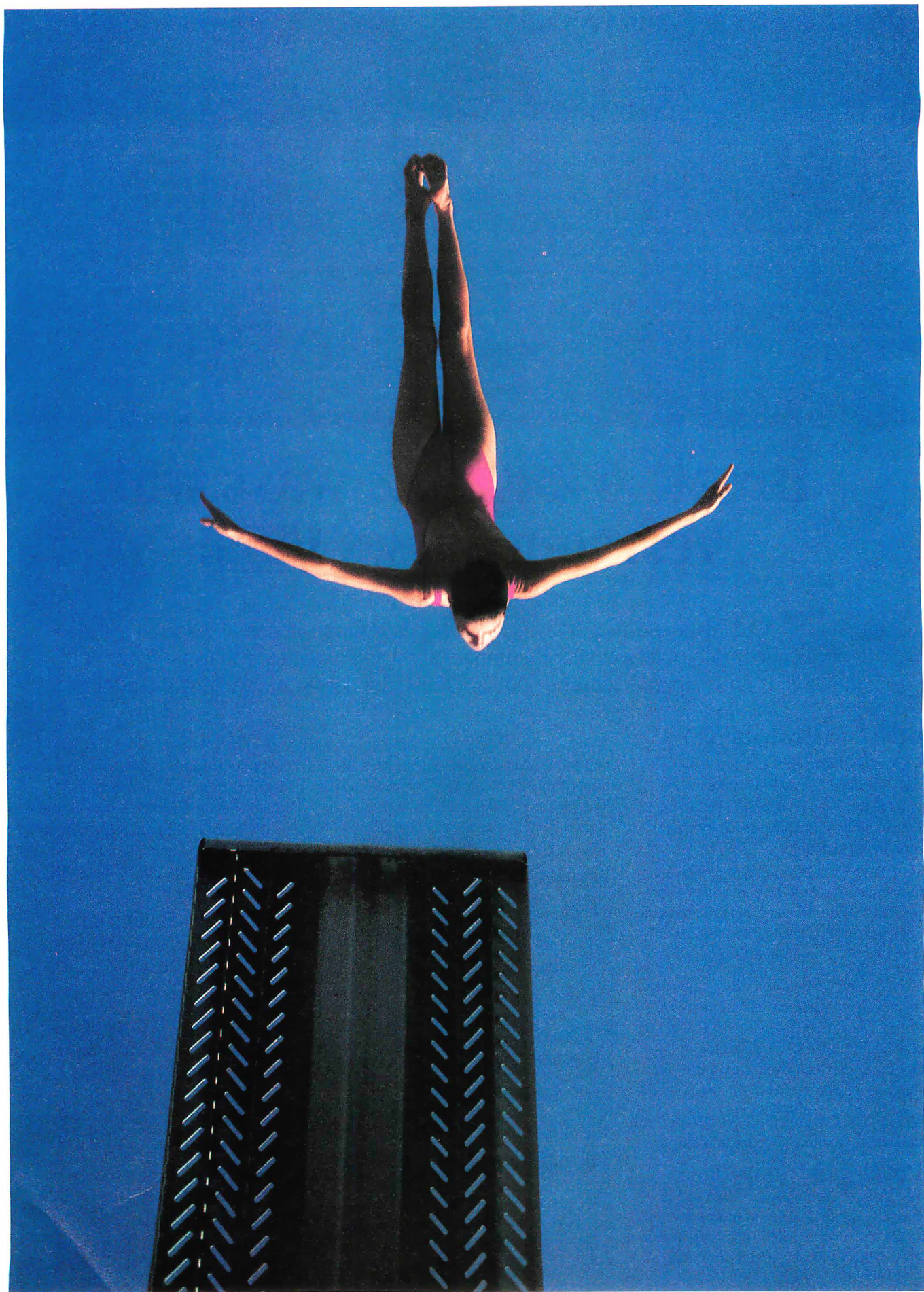
For MS/PCDOS, Vermont Views Plus is \$795; Vermont Views standard edition is \$495. For UNIX, POSIX, and VMS, prices start at \$1,795, depending on machine class.



**Vermont
Creative
Software**

1 Pinnacle Meadows Richford, VT 05476 USA
Phone (802)-848-7731 FAX (802)-848-3502
#373

For a FREE demo of the ultimate application interface, call 800-848-1248.



The drive and determination to advance can be seen in many forms. Here's a couple we think you'll be excited about.



Introducing the Microsoft database management systems.

Some people aspire to become famous athletes. Others to become great scholars.

But for a group of us here at Microsoft, there's nothing more important than creating a new line of databases with the tools and technology you need to do your everyday tasks.

For example, some of you will need dBASE® compatibility and unequaled performance. That's why we have Microsoft® FoxPro® 2.5. Some of you need seamless access to data in multiple formats. For you we have the Microsoft Access™ database for Windows.™

But all the tools in the world won't do you much good if you can't get help when you need it. So we have a world-class product support organization to quickly answer all of your database questions.

In addition, we've created a special program for developers that will put you directly in touch with some of our senior product support people.

In the future, our technology will con-

tinue to evolve with you in mind. So what you create today will still work tomorrow. In short, there will be no dead ends.

We're also committed to supporting open standards and compatibility. Currently, we are working with ANSI to develop a standard Xbase language.

Plus we fully support the Open Database Connectivity (ODBC) technology, which will allow you to access files from even more of today's database management systems.

And to ensure there will always be a vast supply of industry-specific products and services to meet your database needs, we're forming strong business partnerships with many other companies.

So if you'd like additional information on Microsoft's database solutions, give us a call at (800) 882-2000, Dept. JF6. And find out just how motivated we are to become your database company.

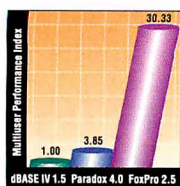


Both Microsoft FoxPro 2.5 and Microsoft Access were created to take complete advantage of the Windows operating system.

Microsoft®
Making it easier



Since the beginning of time, people have been obsessed with reaching ever increasing rates of speed. So what else is new with Microsoft FoxPro 2.5?



Microsoft FoxPro version 2.5 is the fastest PC database management system available today.

Plenty. For starters, the new Microsoft® FoxPro® 2.5 for Windows™ has a rich and productive environment with an intuitive graphical interface. Which means it's never been easier for you to use and develop powerful Xbase applications.

Plus there's a virtual hardware store of tools for both developers and users.

For developers, there are professional tools designed to help you create the most powerful applications possible.

Like the Trace and Debug windows, Project Manager, Menu Builder, Screen Builder and Report Writer.

For users, there are handy tools that make it easy to do complex database tasks without programming. Like Relational Query By Example (RQBE), which allows you to build and see queries instantly. Or the graphical Browse tool, an intuitive way to view data. And finally, Quick Screen and Quick Report, two easy ways to create objects and see data.

And now with the arrival of FoxPro 2.5

for both the Windows and MS-DOS® operating systems (and soon for the Macintosh® and UNIX®), you can have the most powerful and most graphical Xbase applications across all major PC platforms. And if you are thinking about migrating to Windows in the future, have no fear. Because Microsoft FoxPro for Windows will easily run all your FoxPro 2.0 files.

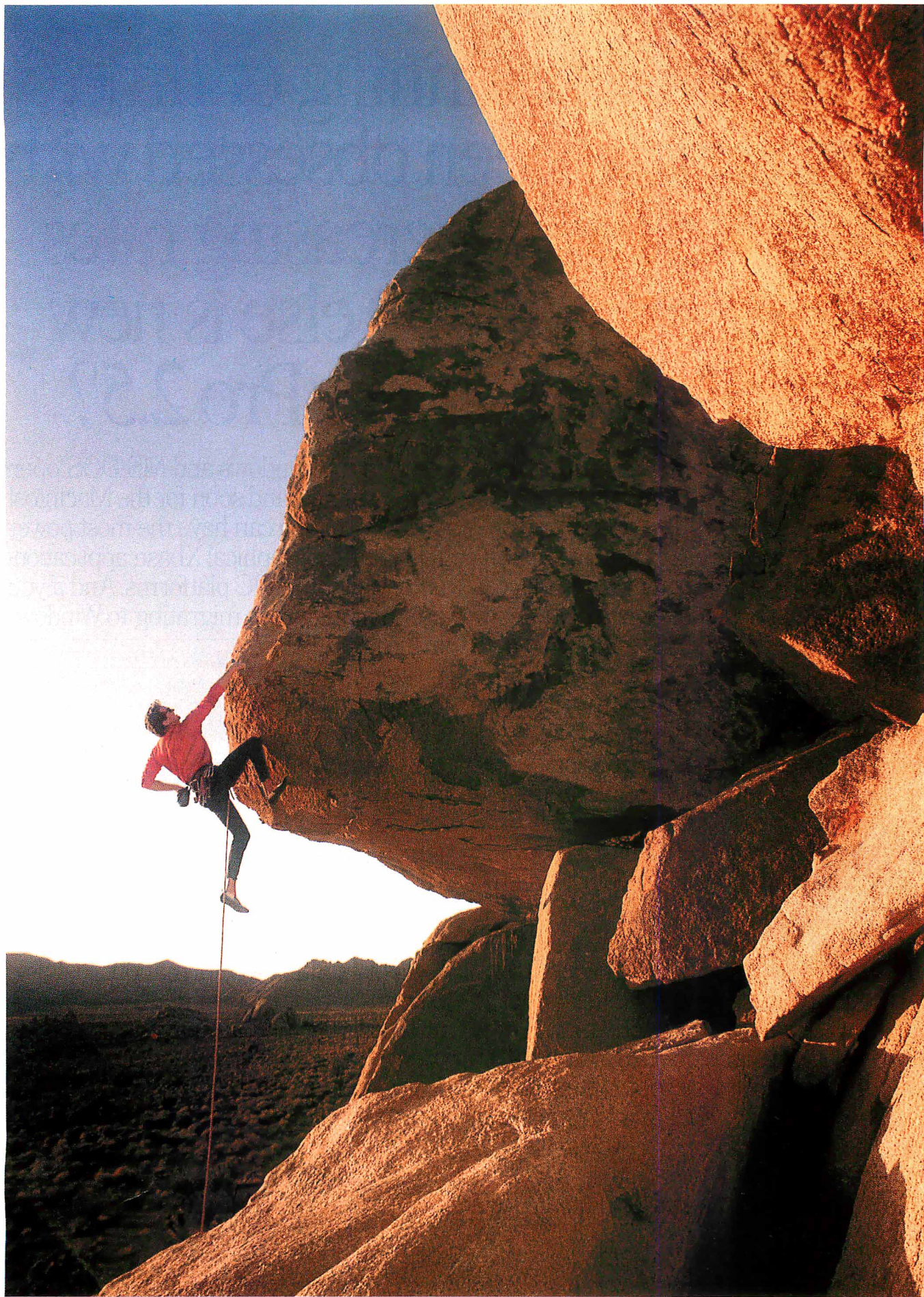
But no matter which platform you choose, you can count on Microsoft FoxPro to provide you with the fastest PC-based database management system.

For additional information, just zip on over to your nearest reseller, or call us at (800) 882-2000, Dept. JF7. We'll be more than happy to tell you all the ways Microsoft FoxPro 2.5 for Windows can get your adrenaline pumping.

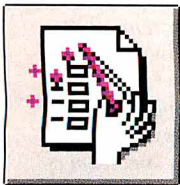


FoxPro 2.5 takes advantage of Windows and allows you to create dazzling applications.

Microsoft®
Making it easier



People always seek the most direct route to achieve their goals. So you've probably been looking for a database like Microsoft Access.



With AccessWizards, you have a guide to walk you through complex tasks, one step at a time.

If you're a database user or programmer, we'd like to show you a great shortcut. It's called Microsoft Access™. It's a new database management system for Windows™ that can give you something no other database can. Easy access to the powerful features you need to do your job.

To start with, Access takes complete advantage of the Microsoft® Windows operating system. Which means it has never been easier to create great-looking forms and reports. Plus you can store objects like pictures, graphs, sound, and video. Right in your database files.

And if you ever get stuck, there are ReportWizards, FormWizards and ChartWizards to come to your rescue. They'll ask you questions about format, content and style. Then they'll automatically create your report, form or chart.

There are also Cue Cards to walk you through the most difficult database tasks. Guiding you one step at a time.

In addition, it's easy to create complex

queries by using the graphical Query By Example. You just drag and drop tables, join fields, and plug in all of the specifics.

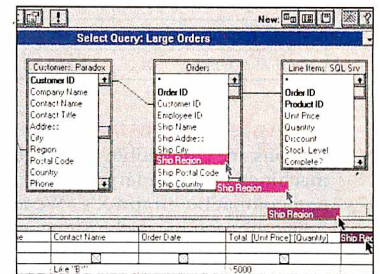
And you developers can write sophisticated database applications with Access Basic. A powerful, extensible programming language.

What's more, Microsoft Access can easily read and write all the major database formats directly, including dBASE®,

Paradox® and Microsoft SQL Server. So you and your coworkers can still use all your old files, no matter what format they are in. That means, your investment is safe and everyone can easily migrate to Microsoft Access at their own pace.

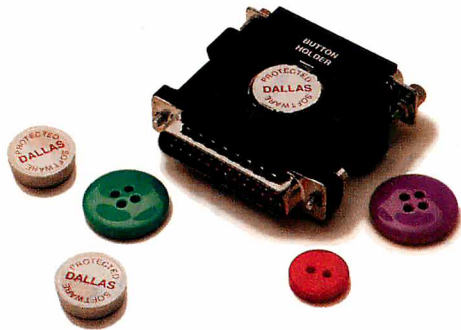
To receive additional information on Microsoft Access, call (800) 882-2000, Dept. JF8. We'll give it to you straight.

Microsoft®
Making it easier



Create complex queries visually with our graphical Query By Example.

PROTECT YOUR SOFTWARE



NO BUTTON, NO ACCESS.

Dallas Semiconductor is re-shaping the world of software protection and distribution control with a new family of microchips called Buttons. We put the lid on software piracy by packaging microchips in button-shaped, stainless steel cans. The chips contain missing but critical information to make the software run.

We offer a variety of Authorization Buttons and features so you can select the level of protection and price point that are right for you.

Security Continuum

Button Type	Unique Serial #	Read/Write Memory	Password Protection	Expiration Timer	Decoy Responses
DS1420 ID Button	X				
DS1427 Timer Button	X	4K bits		X	
DS1425 Multi Button	X	2K bits	X		X

Complete Compatibility

Buttons are compatible across all ISA, EISA, and MCA machines — on underpowered notebooks as well as the anti-compatible Brand X's. We achieve this total compatibility through microchips that are self-powered, unlike other protection devices that must draw power from the host machine.

Snap In, Snap Out

Authorization Buttons interface to the PC's parallel port via the DS1410 Button Holder. They simply snap in and out. The DS1410 accepts two Buttons concurrently.

The future will be a dongleless world. New computers that accept Buttons directly, including palm and notebooks, are being designed at OEM's today.

Made in the U.S.A.

At Dallas Semiconductor, we design and manufacture our own microchips. And we're the only ones in the software protection business who do. Sixty intricate process steps and a 64-bit unique serial number lasered into each chip prevent duplication.

To learn how to button down your software, give us a call.

**DALLAS
SEMICONDUCTOR**

4401 South Beltwood Parkway, Dallas, Texas 75244-3292
Telephone: 214-450-8170 FAX: 214-450-3715

FREE!
Authorization Button.
Call 800-258-5061



LETTERS

I am concerned about the absurd comparisons made in your "Stalking the Ultimate Workstation" review. Ben Smith and Raymond GA Côté did a disservice to your readers by comparing the least powerful Next computer to other, much more expensive and fully configured computers. They should have tested the Nextstation Turbo Color or the Nextdimension systems. These are much faster machines, and they would have been less expensive than most of the computers tested.

Eric M. Hall
San Francisco, CA

We received many letters about our "Stalking the Ultimate Workstation" review. Most came from Next enthusiasts whose main criticism was that we didn't compare a more powerful Nextstation against the higher-performance (and more expensive) workstations from other vendors.

It's important to note that none of the other machines were fully configured or optimized, either. And performance didn't always win out. IBM's RISC System/6000 exceeded in raw performance, but it scored low for its user interface and cost.

It's impossible to perform a scientific comparison of systems that have different CPUs, operating systems, and user interfaces. The only way to evaluate this spectrum is to call them as we see them, and that's what we did.

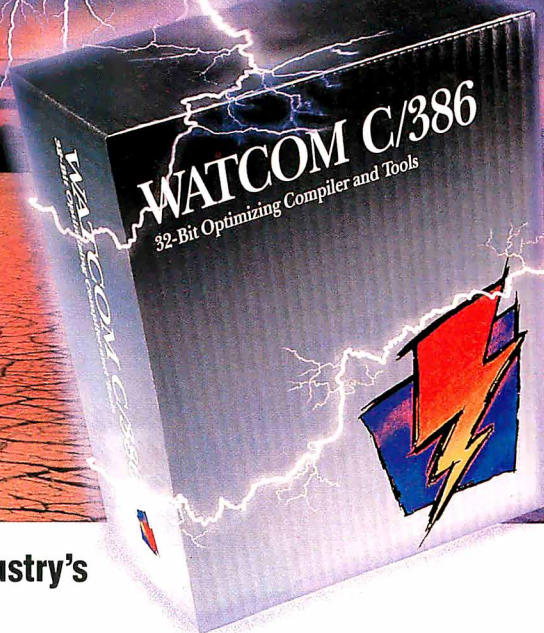
Thanks for your letters.—Ben Smith

FIXES

- In the Ask BYTE section (see "BYTE on UUNET," November 1992), the address given for FTP access to UUNET is incorrect. The correct address is ftp.uu.net. You should then log on as "anonymous" and use your user ID (i.e., "userid@host") as your password.
- David Giller's letter ("Unix for Nothing," November 1992) on Linux contains the correct FTP address but the wrong case syntax. The FTP address should read nic.funet.fi:/pub/OS/Linux.
- In "Style Meets Substance in Matrox Studio" (November 1992), the price for the Matrox Studio package is incorrectly quoted at \$14,000. The correct price is \$15,995.
- Compaq's color notebook computer is incorrectly referenced as the Compaq LTE 386 Lite/25 in "BYTE's Essential Guide to Notebook PCs" (BYTE's Essential Guide to Portable Computing, 1992). The correct name is the Compaq LTE/Lite 25C. Also, in the same issue, the text box "Portable Fax Software Rated for DOS and Windows" on page 52 contains a misleading statement about Eclipse Software's Eclipse Fax. In most cases, Eclipse Fax performs true manual receive. The author was referring to manual receive attempts made through a hotel switchboard when he stated otherwise. For more details on Eclipse Fax, see "Forging a Business Tool: Three Fax Software Packages for Windows" on page 209.
- In BYTE's Essential Guide to Windows, 1992, we incorrectly identified XTree Co.'s product as XTree Gold for Windows. The correct product name is XTree for Windows. The address is 4115 Broad St., Building 1, San Luis Obispo, CA 93401. ■

Delivering the Power: WATCOM C9.0/386

- ▶ **The Widest Range of 32-bit Intel x86 Platforms**
32-bit DOS, 32-bit Windows, OS/2 2.0, AutoCAD ADS
- ▶ **The Industry's Leading Code Optimizer**
Advanced global optimizer with new 486 optimizations
- ▶ **The Most Comprehensive Toolset**
Debugger, profiler, protected-mode compiler and linker, 32-bit DOS extender with royalty-free run-time, licensed components from Microsoft SDK, and more
- ▶ **The Best Value in 32-Bit Tools: \$895***



Unleash 32-bit Power!

WATCOM C9.0/386 lets you exploit the two key 32-bit performance benefits. The 32-bit flat memory model simplifies memory management and lets applications address beyond the 640K limit. Powerful 32-bit instruction processing delivers a significant speed advantage: typically at least a 2x speedup.

You Get:

- ▶ 100% ANSI and SAA compatible compiler and libraries C9.0/386 passes all Plum Hall Validation Suite tests
- ▶ Extensive Microsoft compatibility simplifies porting of 16-bit code
- ▶ Royalty-free run-time for 32-bit DOS, Windows and OS/2 apps
- ▶ Comprehensive toolset includes debugger, linker, profiler and more
- ▶ DOS extender support for Rational, Phar Lap and Ergo
- ▶ Run-time compatible with WATCOM FORTRAN 77/386

32-bit DOS support includes the DOS/4GW 32-bit DOS extender by Rational Systems with royalty-free runtime license

- ▶ Virtual Memory support up to 32Mb

32-bit Windows support enables development and debugging of true 32-bit GUI applications and DLLs.

- ▶ Includes licensed Microsoft SDK components

32-bit OS/2 2.0 support includes development for multiple target environments including OS/2 2.0, 32-bit DOS and 32-bit Windows

- ▶ Access to full OS/2 2.0 API including Presentation Manager
- ▶ Integrated with IBM Workframe/2 Environment

AutoCAD ADS and ADI Development: Everything you need to develop and debug ADS and ADI applications for AutoCAD Release 11

Novell's *Network C* for NLM's SDK includes C/386

The Industry's Choice.

Autodesk, Robert Wenig, Manager, AutoCAD for Windows:

"At Autodesk, we're using WATCOM C/386 in the development of strategic new products since it gives us a competitive edge through early access to new technologies. We also highly recommend WATCOM C/386 to third party AutoCAD add-on (ADS and ADI) developers."

Fox Software, David Fulton, President: "FoxPro 2.0 itself is written in WATCOM C, and takes advantage of its many superior features. Optimizing for either speed or compactness is not uncommon, but to accomplish both was quite remarkable."

GO, Robert Carr, Vice President of Software: "After looking at the 32-bit Intel 80x86 tools available in the industry, WATCOM C was the best choice. Key factors in our decision were performance, functionality, reliability and technical support."

IBM, John Soyering, Director of OS/2 Software Developer Programs: "IBM and WATCOM are working together closely to integrate these compilers with the OS/2 2.0 Programmer's Workbench."

Lotus, David Reed, Chief Scientist and Vice President, Pen-Based Applications: "In new product development we're working with WATCOM C because of superior code optimization, responsive support, and timely delivery of technologies important to us like p-code and support for GO Corp's. PenPoint."

Novell, Nancy Woodward, V.P. and G.M., Development Products: "We searched the industry for the best 386 C compiler technology to incorporate with our developer toolkits. Our choice was WATCOM."

WATCOM

1-800-265-4555

The Leader in 32-bit Development Tools

415 Phillip Street, Waterloo, Ontario, Canada. Telephone: (519) 886-3700. Fax: (519) 747-4971. *Price does not include freight and taxes where applicable. Authorized dealers may sell for less. WATCOM C and Lightning Device are trademarks of WATCOM International Corp. DOS/4G and DOS/16M are trademarks of Rational Systems Inc. Other trademarks are the properties of their respective owners. Copyright 1992 WATCOM International Corp.

Circle 148 on Inquiry Card.

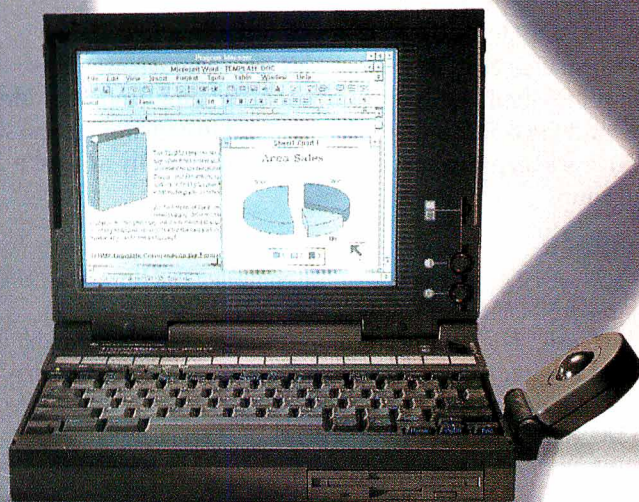


There Is In Nu



TravelMate™ 4000 WinSX™ or WinDX™/25MHz

- 4MB RAM std. (20MB max.)
- 120MB HDD
- 5.6 pounds
- \$2,799/\$3,299 SRP*



TravelMate 4000 WinDX2™/50MHz

- 8MB RAM std. (20MB max.)
- 200MB HDD
- 5.6 pounds
- \$3,899 SRP*

Texas Instruments comes on strong with the widest selection of powerful 486 notebooks at incredible prices. From 25MHz to the world's most powerful 50MHz notebook in a 5.6-pound package, there's a TI TravelMate just for you.

Take a look at these numbers. You get superior 486 performance with an extraordinary three to five hours of battery life.



MICROSOFT
WINDOWS
READY-TO-RUN



Strength Numbers.



TravelMate 4000 WinSX/25MHz COLOR

- 4MB RAM std. (20MB max.)
- 120MB HDD
- 6.3 pounds
- \$3,699 SRP*




TravelMate 4000 WinDX2/40MHz COLOR

- 8MB RAM std. (20MB max.)
- 200MB HDD
- 6.3 pounds
- \$4,499 SRP*

On our color models, you get 256 simultaneous brilliant colors on a large 9.4" display. All these numbers add up to outstanding performance and value.

There's one more important number. For more information and the dealer nearest you, call 1-800-527-3500.

 **TEXAS
INSTRUMENTS**

*Manufacturer's Suggested Retail Price. Dealer prices may vary.

TravelMate, WinSX, WinDX and WinDX2 are trademarks of Texas Instruments. The Ready-to-Run logo is a trademark of Microsoft Corporation. The Intel Inside logo is a trademark of Intel Corporation.

Circle 141 on Inquiry Card.

NEWS

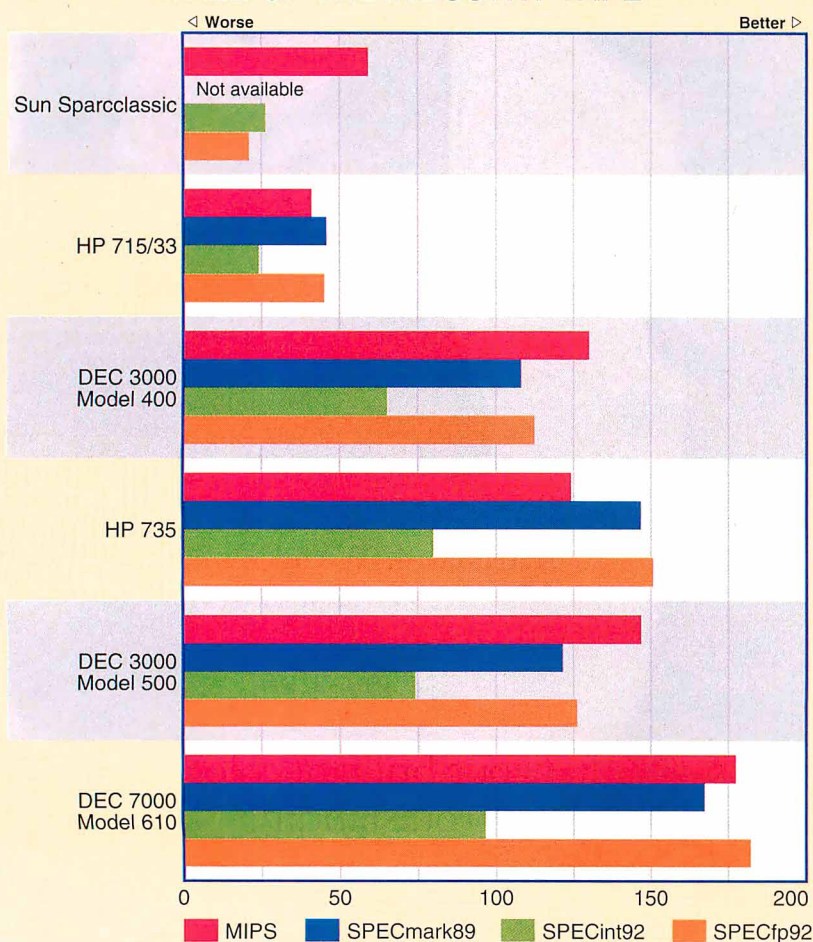
MICROBYTES

Battle of the Workstation Stars

It was a Super Tuesday in November for Unix workstations as three arch rivals—Sun Microsystems, Hewlett-Packard's workstation systems group, and DEC—unveiled several systems built around new high-power CPUs. Sun staked a claim in the low-end workstation turf by unveiling workstations based on the low-priced RISC microSparc microprocessor. HP's workstation systems group based in Chelmsford, Massachusetts, took jabs at DEC, IBM, Silicon Graphics, and Sun with systems based on the single-chip Precision 7100 processor. In addition, DEC introduced the first of its Alpha AXP workstations based on 64-bit RISC technology.

Only Sun's Sparcclassic and Sparcstation LX and DEC's Alpha AXP workstations running Open VMS AXP were shipping in volume as of last December. The other workstations are slated to ship in the first quarter of this year. DEC also plans to

TALE OF THE INDUSTRY TAPE



SPECmark89 measures CPU-intensive, single-stream performance. SPECint92 and SPECfp92 measure CPU and FPU performance, respectively. MIPS ratings are based on the Dhrystone 1.1 benchmark. Higher numbers are better.

NANOBYTES

Portable workstation developer **Tadpole Technology** (Cambridge, U.K., and Austin, TX) says it will make notebook workstations based on the PowerPC 601 RISC processor being designed by IBM and Motorola. Under terms of an agreement that at press time was contingent on the completion of equity negotiations between the two companies, Tadpole will develop and IBM will market the notebooks. □

"Multimedia for business, government, and education is in its adolescence, but for the home, it's very much in its infancy," says **Mike Braun**, IBM's assistant



general manager for multimedia. In Braun's view, the home offers two potential "spaces" of interest: the living room (entertainment) and the den (computers). Commodore's

CDTV, Philips' CD-I (Compact Disc Interactive), and Tandy's VIS are "aimed at the living room," Braun says, but "they're not making it, and they won't make it." The reason? "People expect something at least as good as TV or in the price range of Nintendo, but these are in the middle," he explains. □

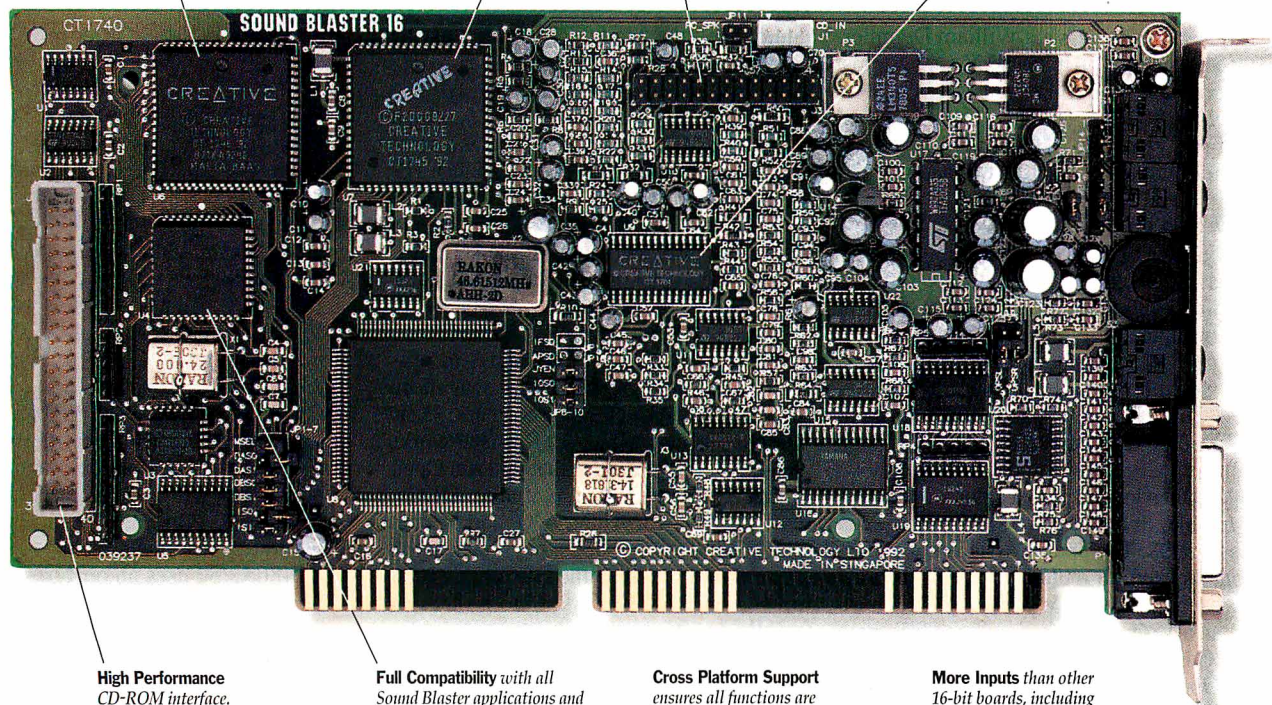
The mainframe as a multimedia server? At Comdex, IBM had an ES-9000 mainframe and showed various full-motion video applications running across network and T1 leased-line connections to Dallas, Texas; Raleigh, North Carolina; and Chicago. IBM also rolled out **UltiMotion**, its software solution for delivering full-motion video and audio on a computer. □

Advanced Signal Processing (ASP) delivers 4:1 realtime hardware data compression and saves up to 65% of CPU processing time.

Enhanced Features include programmable mixing, multiple-source recording, treble and bass controls.

Wave Blaster™ upgrade option for next generation wave table music synthesis.

State-of-the-Art 16-bit Codec with 90 dB signal-to-noise ratio.



Sound Blaster 16 ASP. We're not playing games anymore.

Sure, games are great. But with new applications ranging from voice recognition to full-blown integrated multimedia, it's time to get serious about PC audio. With Sound Blaster™ 16 ASP.™

The 16 ASP comes with all the features you'd expect on a professional-quality sound board, plus more than \$500 in bundled software...all for a suggested retail of just under \$350.

But the real secret lies in Creative Labs' exclusive Advanced Signal Processing technology: realtime hardware data compression that delivers full CD-quality stereo at a fraction of the CPU power required by other

16-bit boards. And downloadable algorithms that enable future upgrades like voice recognition, time control and special effects.

So if you thought the original Sound Blaster set the standard for games, you're right. But the 16-bit PC Sound Barrier has now been broken. With Sound Blaster 16 ASP: the new Sound Standard for CD-quality PC Audio.

For more information call 1-800-998-LABS.



**Sound
BLASTER**

CREATIVE
CREATIVE LABS, INC.



© Copyright 1992 Creative Labs, Inc. All specifications subject to change without notice. Sound Blaster, ASP, and Wave Blaster are trademarks of Creative Labs, Inc. All other software and trademarks are owned by their respective companies. International inquiries: Creative Technology Ltd. Singapore, TEL 65-733-0233. FAX 65-773-0353.

Circle 151 on Inquiry Card.

NEWS

MICROBYTES

release this spring what William Demmer, vice president of Alpha and VAX systems, describes as "the world's fastest Windows machine." DEC officials said the system will run Windows NT and will be priced competitively with Intel 486 machines.

Low Sun on the Horizon

Sun's two SPARC-compatible workstations and a server cost about the same as high-end 486-based PCs but offer superior performance. All three Sun machines use the new RISC-based microSparc processor (for more details on the microSparc, see "Coming Soon: Sparc Workstations at PC Prices," December 1992 BYTE, page 30). At \$4295, the Sparcclassic is (for now, at least) the lowest-priced color workstation available. In quantities of 12, it costs even less: \$3995. The Sparcclassic is not a barebones system. It includes 16 MB of RAM (expandable to 96 MB), a 207-MB hard drive, a 15-inch color monitor, a full array of I/O interfaces, and Sun's Solaris 2.1 and the Open Look GUI.

Until Pentium-based machines become available, the Sparcclassic should be capable of outrunning the fastest PCs. Sun says a final production version of the 50-MHz microSparc executes 59 MIPS. A 66-MHz 486DX2 delivers about 54 MIPS. While the microSparc costs only \$179 in production quantities, the fastest 486DX chips cost more than \$500. Sun hints that faster versions of the microSparc are on the way. Sun's other microSparc workstation is the Sparcstation LX, billed as the lowest-priced (\$7995) accelerated graphics computer on the market. The \$5295 Sparcclassic server is similar to the Sparcclassic, but the server comes with a 1-GB hard drive.

HP Spreads Out

All the new HP systems are based on the company's Precision 7100 processor, which Robert Weinberger, manager of product marketing at HP's workstation systems group, said is "the first implementation of PA-RISC that is fully superscalar, capable of dispatching and executing two instructions per cycle." The 7100 includes an integrated FPU.

At the high end, HP introduced the Model 735 (starts at \$34,795) and the Model 755 (starts at \$58,995) workstations. Both systems run on the 99-MHz 7100 processor and run HP-UX 9.0. Graphics options range from eight-plane gray-scale (GRX) to 24-plane accelerated, double-buffered color (CRX-48Z).

At the low end (prices start at \$4995; prices for color versions start at \$5695), HP

announced the Model 715, which uses a 33-MHz version of the 7100; a 50-MHz version is also available (\$11,895). HP also announced its desktop Model 725, which runs at 50 MHz and can function as a server due to four EISA slots (\$17,895). HP says that, except for the CRX-48Z, all its graphics options will be available up and down the new workstation line so that it can compete head-on with Silicon Graphics.

A New Start for DEC

DEC officials pulled no punches in reiterating that the Alpha rollout was more than a new product announcement. DEC announced two Alpha AXP-based workstations and five servers that will run Open VMS AXP and, when available, DEC's 64-bit OSF/1 for Alpha AXP and Microsoft's Windows NT operating systems. All systems are based on the DECchip 21064 processor. DEC is working to protect its existing customer base by providing native compilers and binary translators for moving Open VMS VAX applications to the Open VMS AXP 1.0 operating system.

As applications areas such as multimedia, imaging, and virtual reality move forward, 64-bit addressing will help those applications reach their potential, said Demmer. DEC promises that the 64-bit OSF/1 for Alpha AXP will run applications written to popular Unix variants such as System V, OSF, and Berkeley derivatives.

Heading up the Alpha AXP lineup is the DEC 3000 Model 400 AXP at \$14,995. The DEC 3000 Model 500 AXP workstation (\$38,995) runs on a 150-MHz processor. On the server side, DEC announced the 133-MHz DEC 3000 Model 400S AXP system (\$18,995) and the 150-MHz DEC 3000 Model 500S AXP (\$41,195) desk-side system. The DEC 4000 Models 610 and 620 AXP distributed/departamental systems are available in single- and dual-processor symmetric multiprocessing configurations. Dual 160-MHz processor configurations provide 247 SPECthruput89 performance, DEC says. Single-processor DEC 4000 systems start at \$77,000. The DEC 7000 data center is available with up to six 182-MHz processors.

Although system performance is important (see the figure), the success of DEC, HP, and Sun will not be determined solely on the basis of MIPS and SPECmarks. To substantially increase their sales, the companies will have to market their systems as not only fast but also supported by a wide range of applications.

—Dan Muse, Tom Halfhill, and
Dave Andrews

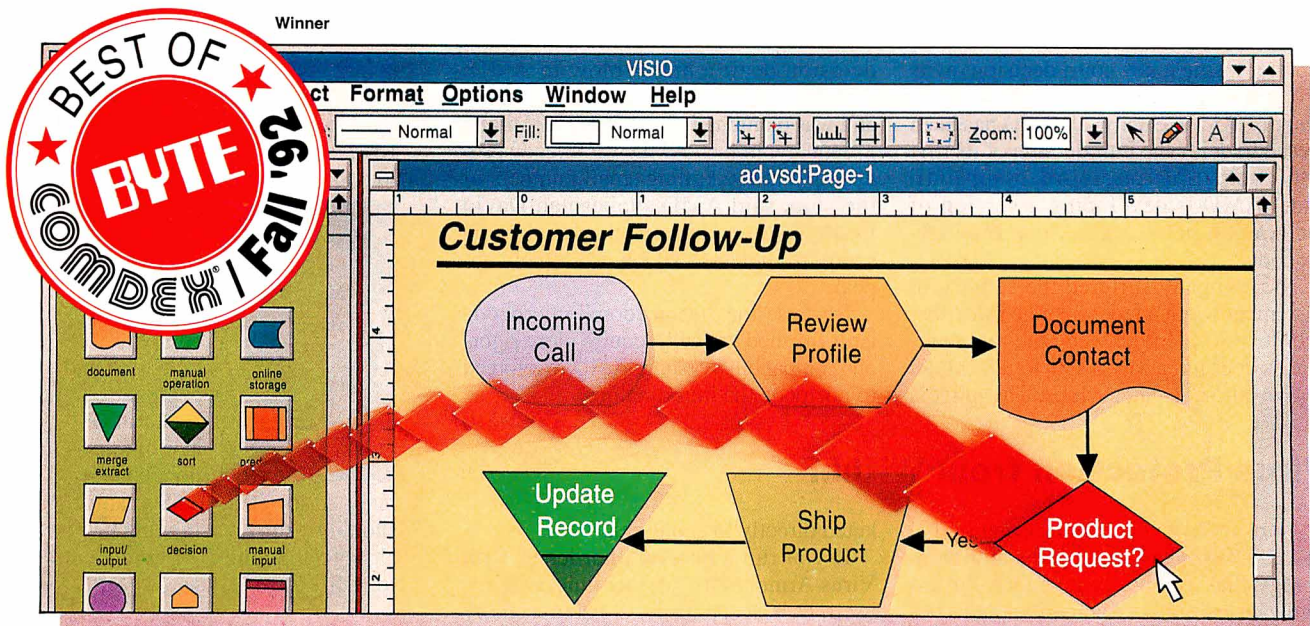
NANOBYTES

Cyrix (Richardson, TX) says it plans to bring its second 486 socket-compatible CPU to market by June. The chip is code-named the **M7**. The **Cx486S2/50**, Cyrix's new 486SX compatible, is sampling now and is expected to reach volume availability by March. Targeted at the 486SX market segment—particularly Intel's 33-MHz 486SX—the Cx486S2/50 runs at 50 MHz internally and 25 MHz externally. Unlike the future M7 chip, which Cyrix says will have an integrated FPU, the Cx486S2/50 requires a separate FPU module. The Cx486S2/50 uses an on-board write-back cache, eight write buffers, and burst writes to cut down on CPU bus traffic. Cyrix plans to sell the chip for \$249 in quantity, or about \$60 more than Intel's 486SX/33. □

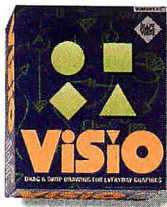
The latest word from **Watcom**, which is beta testing a Pentium optimizing compiler, confirms that to get the true performance out of Intel's next-generation chip, you need to optimize code. David Boswell, spokesman for the Waterloo, Ontario-based company, said, "We're beta testing our Pentium compilers with various ISVs [independent software vendors] who have the kind of applications that need a lot of cycles. The results are really encouraging." Boswell said Watcom used its best compiler that's now shipping retail, compiled an application, and ran it on a Pentium-based system. It then used the special Pentium optimizing compiler to run it on the same system. "Compiling the same app, you sure notice a dramatic improvement from those Pentium optimizations," he said. □

Microsoft is developing a smart forms-routing program code-named **Calvin and Hobbes** for Windows for Workgroups, sources said. Sources also said the company is working on a small-business accounting program for Windows, code-named Boris. □

VISIO IS FOR ANYONE WHO THINKS DRAWING IS A DRAG.

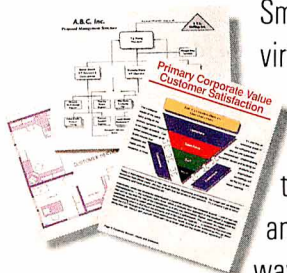


Now you don't have to be a graphic artist or draftsman to create impactful business and technical drawings. Because *if you can drag and drop, you can draw*. It's easy with Visio™, Shapeware's™ new drawing program for Microsoft® Windows™ 3.1 users.



By just clicking your mouse, Visio lets you drag and drop shapes, change their size or color, connect them automatically and type in text. Drag. Drop. Done! It's that easy.

Only Visio gives you more than 300 drag and drop SmartShapes™ to help you create virtually any drawing or diagram.



Unlike clip art, SmartShapes are "intelligent." They can take on different forms, colors, and proportions and behave the way you expect. And with

Visio's simplified tool set, you can easily create your own customized shapes using a single pencil tool.

For easy access, SmartShapes appear right on your screen on job-related "stencils." Each stencil features all the shapes you could possibly need for your specific drawing.

There's a Visio stencil for flowcharts. One for space plans. Organizational charts. Business models. Marketing diagrams. Gantt charts. Computer network layouts. Engineering schematics. And direction maps. Visio includes 15 stencils, standard. And you can also get additional stencils for more specific jobs.



So if you need to concentrate on *what* you want to draw, not *how* to draw it, you need new Visio from Shapeware. The only Windows software that lets you draw from more than your imagination.

SPECIAL CHARTER OFFER.

Buy Visio now for just \$249. And if you order and register by April 30, 1993, you'll also receive: ■ An additional Visio stencil set of your choice ■ A free issue of *Windows*, *Windows Sources*, and *Windows User* magazines ■ Free technical phone support for 90 days ■ A 60-day money-back guarantee. To order Visio, or for the names of authorized Visio resellers near you, call toll-free:

1-800-446-3335, ext.EB1



AMD vs. Intel: Back to the Breadboard

After losing a key court decision on its use of Intel microcode in future chip designs, AMD (Sunnyvale, CA) has been forced to delay the introduction of its first 486-compatible microprocessor until June. AMD is developing a version of the Am486 that does not use Intel microcode.

The company suffered the setback in December when a federal judge ruled that a 1976 agreement between the two companies does not allow AMD to use Intel's microcode in its latest chips. The judge's

decision dealt a major blow to AMD, which had anticipated a favorable ruling and was planning to introduce the Am486 in January. In fact, AMD was already producing and stockpiling small numbers of the chip, said AMD spokesman David Frink. Those chips will probably be scrapped, unless AMD wins a timely appeal.

Because the "clean room" microcode isn't finished and will require more rigorous compatibility testing, AMD was forced to postpone the introduction.

—Tom Halfhill

Virus Protection from Within

Start-up Rosenthal Engineering ((310) 207-9948) has developed a new technology that it hopes will render current hardware and software antivirus approaches obsolete by protecting executable files from within the files' code. The company plans to market the technology to corporate clients who want to fortify their custom applications and to commercial software developers.

Rosenthal says Virus Armor is deliberately attached to a DOS or Windows application's code to "harden" it against virus attack. When Virus Armor is integrated into program code, it compresses and encrypts the files of a licensee's application. A licensee can harden all the application's files, for maximum protection, or selected files only. The technology will not be mar-

keted directly to end users.

If you run a program hardened with Virus Armor, Virus Armor quickly scans itself, its host application, system memory and boot sector, and accessible floppy disks. If that scan finds a virus, you can scan the entire system to locate the virus and reinstall the infected program from clean master disks. Virus Armor's compression algorithm reduces the size of a hardened application. When Virus Armor detects an attempt to modify its code, it immediately reboots the system.

Virus Armor will eventually support Windows NT, OS/2, and the Mac. One caveat is that Virus Armor is applications-specific software: It only works when you load a hardened application.

—Ed Perratore

SunSelect Intrigues with WABI for Unix

Want to see your unmodified Windows 3.1 shrink-wrapped applications swish around with blazing speed on an X Window System-based Unix box? At Fall Comdex, SunSelect intrigued show goers with its demonstration of Windows applications running fast on a Sun Sparcstation. Such a technology, when released as a product, could mesh nicely with Sun's new high-powered, low-cost color Sparcclassic.

"Basically what we've done is, we've remapped the Windows API to the X Window System," said Tripp Blair, group marketing executive for emulation technologies at SunSelect (Billerica, MA). Blair said SunSelect refers to the technology internally as WABI (Windows Application Binary Interface). Unlike SunPC, SunSelect's program based on Insignia Solutions' emulation technology, WABI does not let you run DOS programs.

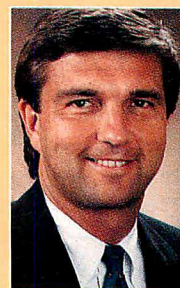
"Because Windows applications have to be written to an API, that API starts to separate the software from the hardware," Blair explained. "By implementing a new [WABI] layer, we can take advantage of the underlying hardware on the workstation space and provide very quick performance. We're going to eliminate the performance issue with respect to emulation," he added. When run on a non-Intel platform, however, WABI will still need to occasionally enter DOS emulation mode. Blair estimates that on a RISC platform, WABI is in DOS emulation mode about 15 percent to 40 percent of the time.

According to Blair, the plans are to implement WABI on multiple RISC platforms, as well as the Intel 80x86 platforms. SunSelect isn't saying when WABI will ship as a product.

—Dave Andrews

NANOBYTES

John Soyering, director of software development programs at IBM, said the company is processing about "75 new applications" a



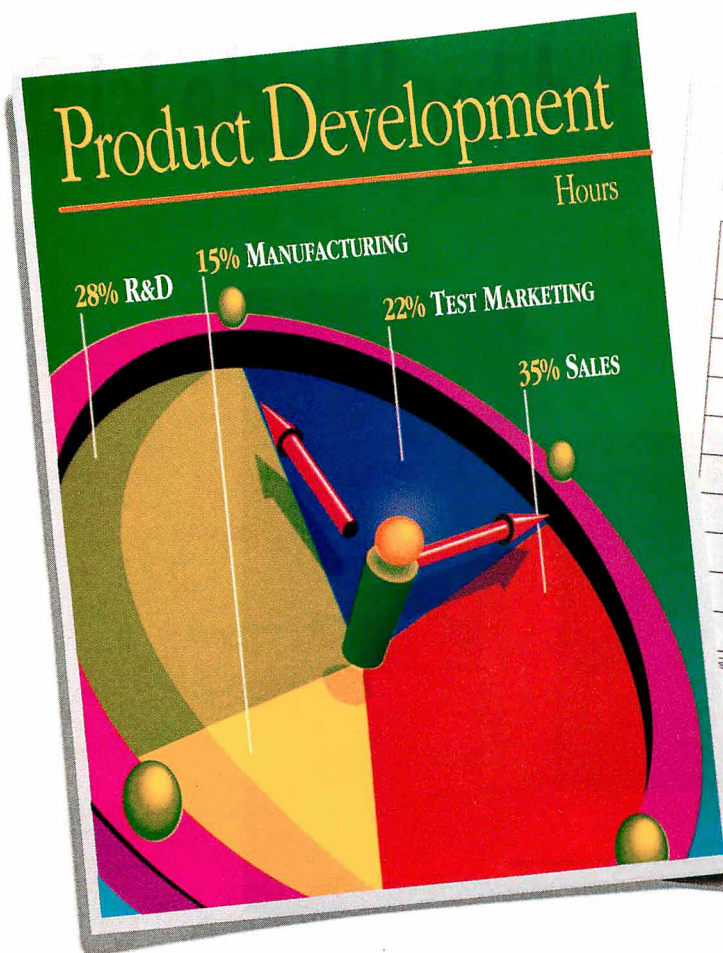
week for 32-bit OS/2 2.0 certification. IBM is now beta testing a C++ compiler for OS/2 2.0, and companies such as Borland International, Com-

puter Associates, and Symantec should by now be shipping or close to shipping C++ compilers for OS/2 2.0. □

Borland, IBM, Novell, and WordPerfect have announced a database initiative to let users of Xbase, Paradox, and other database programs access data stored on a variety of software and hardware platforms without having to exit their current application. The **IDAPI** (Integrated Database API) initiative reportedly lets developers create programs that access data that's stored in a wide variety of formats. IDAPI is intended to extend the SQL Access Group and X/Open Call Level Interface. Initial support will come in the form of SDKs (Software Development Kits) from Novell, IBM, and Borland. Computer Associates and Watcom have also pledged to support the standard in their applications development products. □

A joint development agreement between Apple and **Micro Focus** (Palo Alto, CA) will bring the latter company's COBOL development tools to the Mac OS. □

Borland has gone out shopping again. Still digesting Ashton-Tate, Borland has acquired the rights to Orinda, California-based Wordtech's **Arago** line of database management software, including the beta version of Wordtech's Windows database product. □



UNITED HEALTHCARE PURCHASE REQUISITION

REQUESTION NO. 163438

DATE 12-10 REQUESTOR J. Smith DEPARTMENT NEW ORDER TO BE USED FOR

QUANTITY	DESCRIPTION	DATE REQUIRED	DATE PROMISED	TOTAL COST
1	Tektronix Phaser 200 color printer			\$3,695.00
	✓ laser paper			
	✓ 2pp/min			
	✓ Adobe PS Level 2			

APPROVED

RECOMMEND VENDOR *Recommend dual-tray option* COST \$3,695.00

☒ WITHIN BUDGET ☐ OUTSIDE BUDGET

SUPERVISOR	DIRECTOR	PRESIDENT
DEPT. MANAGER	CONTROLLER	CAPITAL COMMITTEE

J. Smith *H. Smith*

Our new color printer not only looks great on paper, it looks great on paper.

True, the brilliant color produced by the new Tektronix Phaser® 200 is captivating. But the price is equally attractive. And though we've become the award-winning leader in color printers by frequently outdoing the competition, this time we've even outdone ourselves. Introducing our newest business work group color printer.



The Phaser 200 is compatible with virtually any business software and can print two colorful pages per minute. No, not two minutes per page—two pages per minute. And even at a speed like that, it still manages to print eye-catching color on common laser paper or transparencies using a separate input tray for each. You select the medium you want at your computer keyboard. And it switches automatically from user to user just as easily, using its parallel, serial, AppleTalk™, or optional EtherTalk™ and Ethernet™ ports.

It has all the advantages of a laser printer. True Adobe PostScript™ Level 2, networkability, Pantone® colors, speed and price. (Did you notice it's only \$3695, slightly below unheard of?) And when you add to that extremely high materials capacity and sparkling TekColor™ output—not just any color, but the indisputably best color in the business—you've got something even better than our previous best. Which is quite a feat.

So stop by your nearest Tektronix dealer or call us at 800/835-6100, Dept. 28J for a free output sample. For faxed information call 503/682-7450, ask for document # 1223. You won't find another business investment that looks this good on paper.

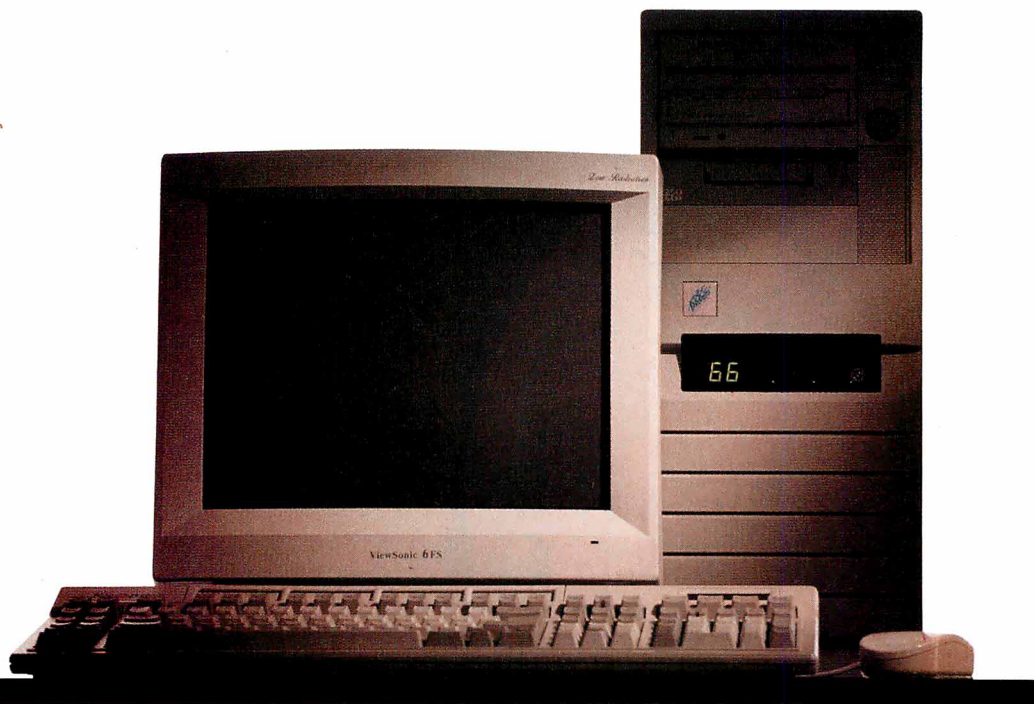


Tektronix

Phaser is a trademark of Tektronix, Inc. PostScript is a trademark of Adobe Systems, Inc. All other marks are trademarks or registered trademarks of their respective companies.

Circle 140 on Inquiry Card.

Highly recommended by Rhode Island



Here at ARES we're making friends for life by the way we make, sell, and support our systems. At least that's what we hear from folks who go by names like "Rhode Island Red," "The Duke of Earl," and "Dr. DOOgie" on the second largest users' group on Prodigy, the ARES users' group.

"... when I opened up the case of my ARES, I knew this was a breed apart. The care given to detail, with all cables braided and tied down where they couldn't snag, the dab of paint on the screw heads so they wouldn't loosen by accident, and the daub of sealant on all the connections to hold them secure, all told me that this machine was no assembly line clone. It is quite obvious that ARES builds computers like a precision machine, not just as a piece of merchandise." — *Ron Liechty*

"My ARES is the fourth or fifth computer that I've owned so I can speak from experience. I've owned Apples, IBMs and a CompuAdd ... the biggest difference about ARES ... they seem to care more about their users after the purchase than any other company I've dealt with." — *Bonnie Williams*

	ARES	Zeos	Gateway	Dell
Two Year Parts Warranty	■			
Tech Support 7 Days/24 Hours	■	■		
60 Day Money Back Guarantee	■			
Limited Lifetime Warranty	■			■
Free On-Site Service First Year	■		■	
Remote Diagnostic Service	■			
72 Hour Burn-In	■			
Fix-Up Disk	■			
Second Year On-Site Service Available	■	■		■
Free Bulletin Board Service	■	■	■	■
Performance Guarantee	■			
Test All Plug and Play Components	■			
Custom Packing of Each System	■			
Certified Documentation of Components	■			
ARES 250 Page User's Manual	■			
Complete Microsoft Documentation	■	■	■	■
Software Technical Support Listings	■			
Custom CMOS Hard Copy	■			
4-5 Page Final Test Printout	■			
Personalized Tech Support Card	■			
Component Screws Sealed in Place	■			
Cables Braided and Tied to Case Frame	■			
Data Cables Siliconed to Connection	■			
"Smart Fan" for Cooling	■			

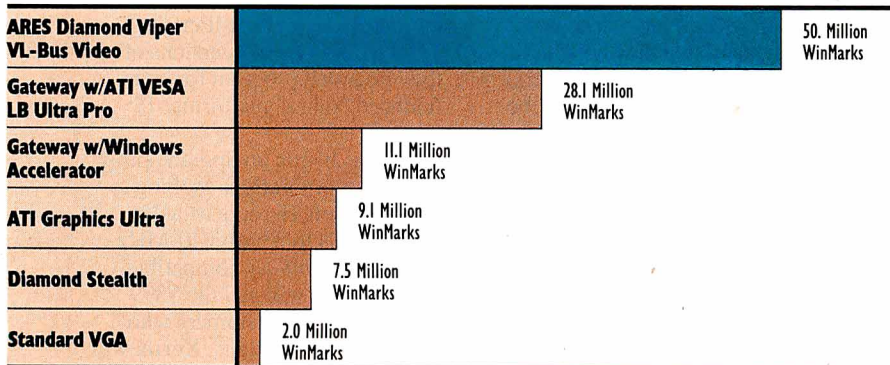
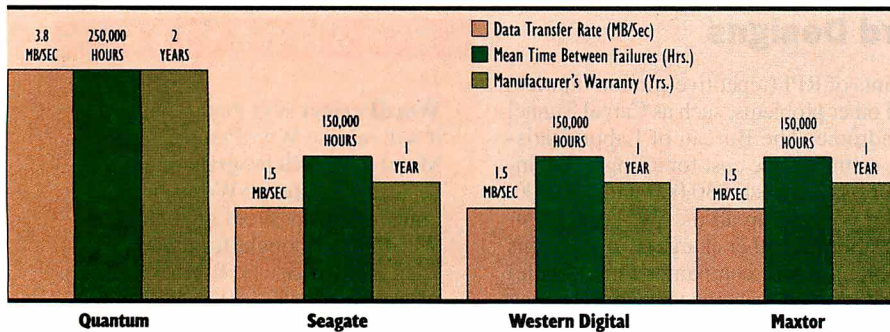
"I researched seven different mail order companies, narrowed it down to Gateway and ARES and ended up with ARES. I purchased an ARES because they are truly a people company ... and they made me feel that I was the most important customer to them." — *Carol Green*

Over the years we have become meticulous about finding the best components to put into every one of our ARES machines. Quantum hard drives. Teac floppy drives. Diamond VL-Bus video cards. And the most powerful, most adaptable motherboard currently available, the new ARES VL-Bus motherboard.

With this ARES VESA (Video Electronics Standard Association) local bus, you can take advantage of these features such as 2.88MB floppy support, fully upgradeable motherboard, two VESA 32Bit Local Bus/ISA slots that support industry standard 32Bit Local Bus cards for video, HD, Ethernet, etc. which will perform up to 10 times faster than EISA, supports on-board RAM of 64MB, a re-programmable FLASH BIOS that protects your investment by allowing future BIOS changes to be installed via floppy disk,

Special order items covered by manufacturer's warranty and return policies. All shipping, handling, and software charges non-refundable. Prices subject to change without notice. Sixty-day return policy begins on date of shipping. All returns must have valid ARES RMA #. All brands and product names are trademarks or registered trademarks of their respective companies.

Red, The Duke of Earl, and Dr. DOOgie.



unbreakable metal SIMM sockets that increase board's life expectancy, and two built-in 32Bit Local Bus IDE adapters which support four IDE devices and double the output. Which is how PC Magazine's Small Records Test shows a 240MB Quantum Hard Drive operated at 2.189 MB/sec. on a standard motherboard while our local bus IDE reached an astounding 5.01 MB/sec.

For the best on-screen performance ARES uses the Diamond Viper VLB (32 bit VESA Local Bus video card) which scores 50 million WinMark (Windows Benchmark) and displays 16 million colors.

You can clearly see the component differences shown in the graphs on this page. What these charts can't show is the

care with which we put them together under the cover. You'll find that our cabinets are made from sturdy 1.5 mm steel, and coated inside with an FCC-approved reflective finish to minimize interference. We also conduct a 72-hour burn-in and a 4-hour, 100-point quality certification test on your machine and include the test results with your system.



Direct Product in the October 1992 issue of PC Sources. And our fussing doesn't stop after the computer is in your hands.

This habit of fussing over our equipment hasn't gone unnoticed over the past ten years. In fact, an ARES system was one of only eight chosen as a Top 100

Our 60-day "No-Questions-Asked" return policy is just one of the ways we stand behind our computers, one of the many "firsts" we've developed to help you feel comfortable with your ARES purchase. Other "firsts" include:

- A two-year warranty on hardware.
- 24-hour/7-days-a-week technical support.
- Two-year, on-site TRW service.
- The first, and still the only company, with a lifetime warranty on service.

So, pick up the phone and call 1-800-322-3200 today. Talk to one of our consultants about the custom configured ARES system that's best for you and your needs. Or, if you like, you can order an instant ARES 486 package, and we'll ship it to you the same day you call.*

Either way we will not charge until your shipment goes out our door (even to APO's), nor will we place a surcharge on your credit card purchase. If you are a business, be sure to ask about our corporate leasing. We also accept purchase orders.

At ARES, we hope you find our fussy style to your liking. For the best components, the most reliable and most durable methods of assembly, right down to our way of doing business with you, we are FUSSY! FUSSY! FUSSY!



**Call 1-800-322-3200 today.
And we'll ship today.**

23660-A Research Dr., Farmington Hills, MI 48335
1-800-322-3200 (313) 473-0808 Fax (313) 473-4450

ARES
MICRODEVELOPMENT, INC.

ARES 486-33DX VL BUS

- Intel 80486-33DX Processor
- Intel 80487 Math Co-processor
- 64K External Cache
- 4MB RAM expandable to 64MB on board
- Two VESA Local Bus slots
- Quantum 170MB IDE Hard Drive or Western Digital Caviar 2200 HD
- Teac 1.44 and 1.2 MB Floppy Drives.
- Viewsonic 6e SVGA Monitor with .28 Dot Pitch
- Diamond Stealth 24 VESA Local Bus Graphics Accelerator Card (Faster than the New ATI Graphics Ultra Pro!)
- Your choice of ARES Platinum Series Keyboard
- 2 Serial and 1 Parallel Port
- DOS 5.0, Windows 3.1 pre-installed with full documentation
- ARES FixUp Program v. 3.0
- Authentic Microsoft Mouse

\$2,245.00

ARES 486-25SX VL-BUS

(Same configuration as above)

\$1,895.00

ARES 486-66DX2 VL-BUS

- Intel 80486-66DX2 Processor
- Intel 80487 Math Co-processor
- 64K External Cache
- 4MB RAM expandable to 64MB on board
- Two VESA Local Bus slots
- Quantum Pro-Drive 240MB HD-with 256K Built-in Cache
- Teac 1.44 and 1.2 MB Floppy Drives.
- Viewsonic 6e SVGA Monitor with .28 Dot Pitch
- Diamond Stealth 24 VESA Local Bus Graphics Accelerator Card (Faster than the New ATI Graphics Ultra Pro!)
- Your choice of ARES Platinum Series Keyboard
- 2 Serial and 1 Parallel Port
- DOS 5.0, Windows 3.1 pre-installed with full documentation
- ARES FixUp Program v. 3.0
- Authentic Microsoft Mouse

\$2,675.00

ARES 486-50DX2 VL-BUS

(Same configuration as above)

\$2,245.00

**Call today,
we'll ship today!**

Circle 162 on Inquiry Card.

*Offer applies to orders placed on Monday through Friday only, during non-holiday periods, for delivery within the continental United States only.

Thumbs Up to New Keyboard Designs

When you face your palms down to use a conventional keyboard, the twisting action, or *pronation*, puts a lot of stress on your hands, wrists, and forearms. This unnatural position has prompted com-



The Vertical keyboard lets you keep your arm in its most natural position.

plaints of RPI (repetitive-motion injuries) and other problems, such as Carpal Tunnel Syndrome. The Bureau of Labor Statistics estimates the cost for a single RPI incident as between \$30,000 and \$80,000, when you add up all the Workers' Compensation and other charges. To solve this problem, major companies (e.g., Apple) as well as start-up companies are designing new ergonomic keyboards.

Jeff Spencer ((619) 454-0000) and Steve Albert ((619) 450-2995) have designed a new type of keyboard that they hope to license to major keyboard manufacturers. They contend that RPI injuries could be eliminated if The Vertical keyboard system (see the photo) were widely adopted.

Apple has also recognized the strains being placed on workers in the information age. You can use Apple's new Adjustable Keyboard as you would a normal keyboard; however, the Adjustable Keyboard splits into two sections that rotate up to 30 degrees apart. This lets you align your wrists to a more neutral position while typing.

—Gene Smarte and Tom Thompson

OLE 2.0: The Road to Cairo?

Microsoft has released beta versions of the OLE 2.0 specification, which Dave Seres, group program manager at Microsoft's interoperability group, said offers developers a path to Cairo, the unreleased object-oriented version of Windows. OLE 2.0 should be released in a Windows 16-bit version in March and a Mac version this summer. Seres said OLE 2.0 offers a framework for object-oriented applications development where applications drive each other. OLE 2.0 will act as a common multiplatform macro language by working across Apple's System 7.0, Windows NT, and 16-bit Windows.

One benefit of OLE 2.0 is in-place object editing. Another feature is link tracking: OLE 2.0 will let you move a subscriber of an object around without its losing its link to the provider.

Features demonstrated in OLE 2.0 have also been shown in a technology called TOOLS (Technology for Object-Oriented Linking and Sharing) from Lotus Development. John Landry, chief technical officer of Lotus, told BYTE that if OLE 2.0 offers features supported in TOOLS, Lotus will support what Microsoft does at the operating-system level.

—Dave Andrews

Apple Stakes Out Color Imaging Market

At the January MacWorld Expo in San Francisco, Apple was expected to announce its first serious entries into the color imaging market. The QuickDraw-based Apple Color Printer, tentatively priced at \$2599, is a 360-dpi color ink-jet printer that supports page sizes of up to 11 by 17 inches (European A3 tabloid) at 65 screen lines per inch. Although it doesn't have a LocalTalk port, the printer is easily shared by multiple Macs: A new printer extension called GrayShare lets other computers

on a network direct their output to the printer, which plugs into the SCSI port of any Mac. GrayShare also handles color and gray-scale imaging.

The company also planned to announce the Apple Color OneScanner, a single-pass, color flatbed device that supports 24-bit color (16.7 million hues) at resolutions of from 75 to 600 dpi. It comes with Ofo to 2.0, a new color version of the one-button scanning software. ■

—Tom Thompson and Tom Halfhill

NANOBYTES

WordPerfect says that in January it will release WordPerfect Works Mac 1.2, a \$249 program that is basically the BeagleWorks integrated-software program that WordPerfect bought from San Diego-based Beagle Brothers. After WordPerfect releases version 1.2 of the program, it will concentrate on making the Mac version compatible with WordPerfect Works for DOS and versions of the integrated program for unannounced "other" platforms. □

Cyrix has begun an upgrade program for corporations looking to upgrade their 16- and 20-MHz 386DX PCs to 33- and 40-MHz 486-instruction-set-compatible CPUs. Cyrix will sell the \$399 Cx486DRu2 to customers who order at least 500 units. Xerox will provide businesswide Cx486DRu2 upgrades through Xerox's Customer Service Organization ((800) 451-4930, ext. 3837). □

The latest word on Solaris for the Intel platform is that SunSoft expects to ship the software early in the first quarter of this year. SunSoft has already released preliminary versions of the operating system to selected testers. □

Future Domain (Irvine, CA, (714) 253-0400) is now beta testing **SCSIWorks**, a universal applications interface for DOS and Windows that promises to end the problems of disparate SCSI software interfaces. The product reportedly allows applications drivers written to interfaces such as ASPI (advanced SCSI programming interface), CD-ROM, INT 13 in DOS, and others to work with Future Domain host adapters. As part of an agreement with Corel (Ottawa, Ontario, Canada), the ASPI-to-CAM portion of the program will be included in three SCSI host adapter kits from Future Domain, along with Corel-SCSI, the SCSI integration software that lets you integrate seven peripherals off a single adapter. ■

First SL notebook.



First Microsoft peer-to-peer notebook.



First upgradable-to-color notebook.



First notebook pre-loaded with
network client shells.



**We'd also be the first to
compare ourselves to our peers.
If we had any.**

You may be surprised to learn Zenith Data Systems is one of the world's biggest names in SL notebooks. Equally surprising is that we're #1 in the U.S. in SL based portables.^{††}

Maybe we're first in sales because we're first in technology. Zenith Data Systems created the first SL notebook. We're the first peer to peer notebook, first up-

For the **only** notebooks
with built-in networking
right out of the box,
call Z-DIRECT.



Now being #1 doesn't mean diddily if we don't deliver. But we're satisfying thousands by offering Z-NOTES of uncompromising quality, with ultra-low Z-DIRECT prices, with unstinting customer assistance and unrivaled Z-CARE service.

So since you're shopping, we invite comparisons. Only Z-NOTE



comes with built-in networking with Ethernet-compatible, high-speed communication pipes for LAN connectivity. Only

**While our
competitors
have been
busy yelling,
we've been busy
selling.
Guess who's #1
in SL portables?^{††}**

The Z-NOTE



**\$1999
Z-DIRECT.
No ups,
no add-ons
no extras.**



Z•NOTE is pre-installed with client software for all three leading network systems—Novell, Microsoft and Banyan. Only Z•NOTE

FEBRUARY
1993



could be the first to pre-install Microsoft Windows for Workgroups. Only Z•NOTE exclusively uses Intel 386SL microproces-

sors. The Z•NOTE has an active matrix color display. The Z•NOTE comes with MS-DOS and Microsoft Windows fully loaded and ready to run, right out of the box.

And only Z•NOTE has the low Z•DIRECT price without additional or hidden charges. Those other guys will charge up to \$500 on extras to match Z•NOTE features, and you still won't

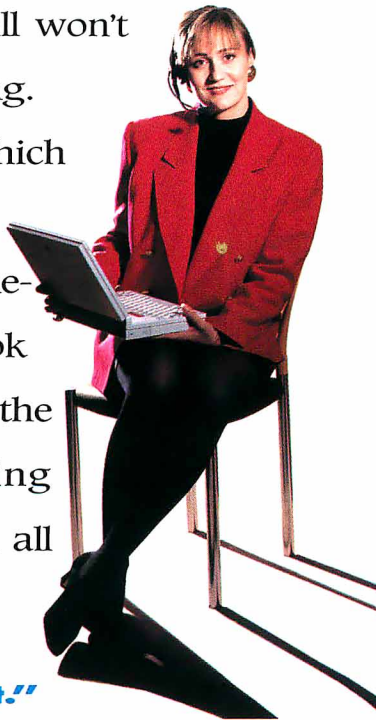
Sandy Blagojev, Z•DIRECT Account Executive. **"You can spend up to \$500 over quote and still not get networking from those other guys."** get networking. So, which will you buy? A johnny-come-lately notebook

from one of them. With none of the above. Or an award-winning Z•NOTE from Z•DIRECT. With all of the above.

"Prices change rapidly. Call for our latest and lowest."



48 hour delivery on all featured products. For product specifications via FAX, please call 1-800-582-8194.



Z•NOTE™ 325L

"Built-in networking"

- Intel® 25 MHz i386™SL **upgradable to i486™**
- 4MB RAM user expandable to 12MB
- 85MB hard disk drive with MS-DOS® 5.0, Microsoft® Windows™ 3.1 and **Microsoft Windows for Workgroups™** pre-installed
- Logitech® TrackMan® Portable mouse
- 9.5" black-on-white LCD, upgradable to active matrix color, 640 x 480 VGA with support for 64 grey shades, and simultaneous video support
- 3.5" 1.44MB floppy disk drive
- 8.5" x 11.9" x 1.9" only 5.9 pounds
- Rapid-charge nickel metal-hydrate battery for up to 4 hours* continuous use or up to 10 hours* under Rest/Resume condition
- **Pre-installed network client software for Novell® NetWare®, Microsoft LAN Manager,™ Banyan® VINES®**
- **Ethernet-compatible high-speed communication port for LAN connectivity**
- 82-key keyboard with 12 full-size function keys

New Lower Price

\$1999

Save \$400



Z•NOTE 325Lc

"Incredible color and price"

- Intel 25 MHz i386SL **upgradable to i486**
- 4MB RAM, user expandable to 12MB
- 120MB hard disk drive
- MS-DOS 5.0, Microsoft Windows 3.1 and **Microsoft Windows for Workgroups** pre-installed
- Logitech TrackMan portable mouse
- 8.4" active matrix color VGA LCD, simultaneous video support
- 3.5" 1.44MB floppy disk drive
- 8.5" x 11.9" x 2.1" only 6.5 pounds
- Rapid-charge nickel metal-hydrate battery for up to 2.5 hours* continuous use or up to 6.5 hours* under Rest/Resume condition
- **Pre-installed network client software for Novell NetWare, Microsoft LAN Manager, Banyan VINES**
- **Ethernet-compatible high-speed communication port for LAN connectivity**
- Optional READYDESK™ Port Replicator (\$107)

New Lower Price

\$3499

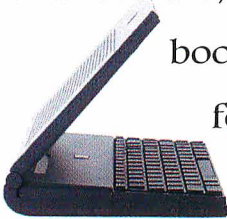
Save \$500

*Battery life depends on application used, power management features selected and peripherals attached.

**Network now with Z•DIRECT.
1-800-289-1317**

**Call Z-DIRECT
for the first
flyweight
heavyweight.**

Chances are, what those new lightweight subnotebooks you're considering are light on are features and functionality. Especially if you use Microsoft Windows. So it's a



good thing you've discovered new Z-LITE 320L. Because no lightweight does Microsoft Windows like Z-LITE. Z-LITE combines every heavyweight feature you need to run Microsoft Windows in an ultra-lightweight PC. Like the power of Intel 386SL technology—instead of the no-name chip others foist off on you.

**The first
subnotebook
with two
PCMCIA
TYPE II SLOTS.**

The Z-LITE 320L includes our energy-efficient 3.3V design. It's our newest technology breakthrough, rewarding you with extraordinary battery life and extraordinary features. We even include an "at-a-glance" battery fuel gauge.

**The first
subnotebook
with backlit
VGA.**

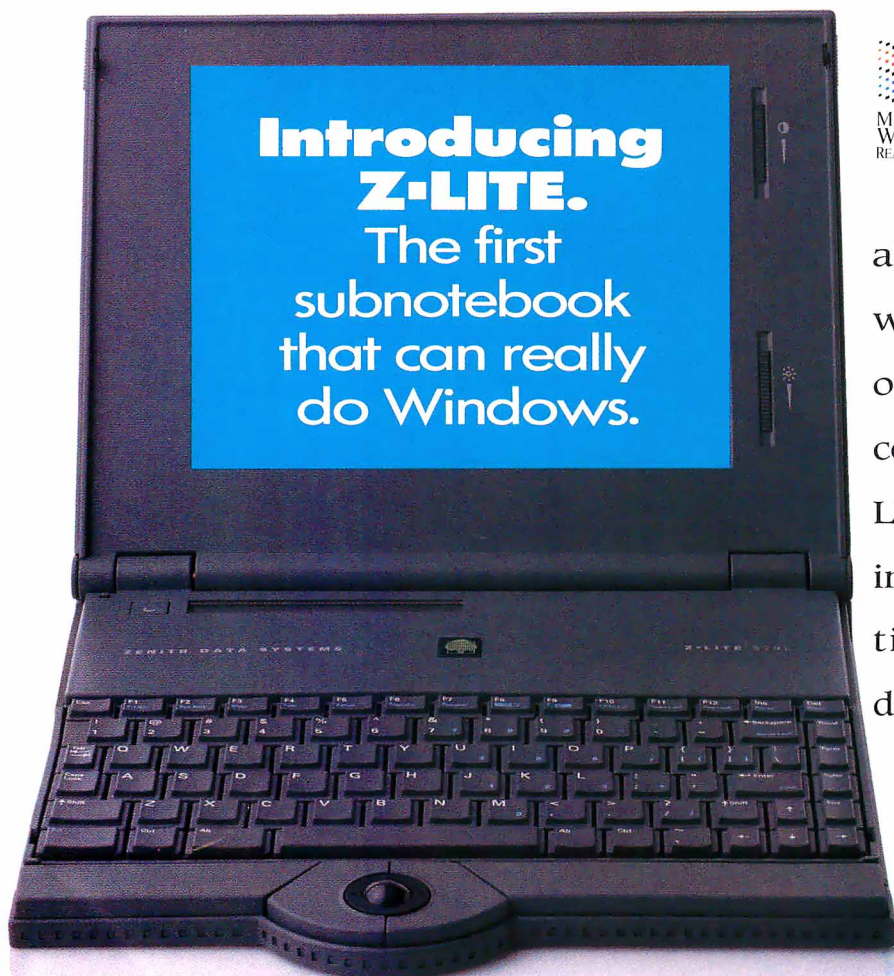
**Introducing
Z-LITE.
The first
subnotebook
that can really
do Windows.**



Then there's our full size 8.4" backlit VGA display. Rather than the pint-size unreadable screen you find elsewhere. You'll enjoy handling our upfront and center, integrated LITEPOINT pointing device. Others offer a tiny control that seems designed for Lilliputians.



**The first
3.3V
386SL
subnotebook.**



FEBRUARY
1993

So what more can we do for you?

Z•LITE 320L gives you flexibility and options. There's two PCMCIA card slots for accommodating high speed data/fax modems, wireless communications and more.

And to make your life easier, we've combined the external floppy disk drive and AC adapter/charger in an all-in-one design.

Z•LITE 320L is the best of Zenith Data Systems technology, with an unbeatable Z•DIRECT

**"Z•LITE is
light years
ahead of the
competition!"**

Margie Silha,
Zenith Data
Systems

price. If lightweight is the way
you want to go, Z•LITE 320L is
the route to take.



Network now with Z•DIRECT.
1-800-289-1317

New Z•LITE



Z•LITE™ 320L

"Full featured subnotebook"

- Intel 20 MHz i386SL (3.3V)
- 2MB RAM user expandable to 6MB
- 60MB hard disk drive
- MS-DOS 5.0 pre-installed
- Optional 3.5" 1.44MB floppy disk drive
- Optional LITEPOINT™ two-button detachable pointing device
- 8.5" VGA backlit black-on-white display with 64 grey scales
- Two PCMCIA type II slots
- NiMH battery pack for up to 3-hours* continuous or up to 6-hours* charge
- 7.6" x 9.9" x 1.5" sloping to 1.1"
- 3.9 lbs.

\$1899



ZDS 625nl

"Affordable portable computing"

- Intel 25 MHz i386SL
- 2MB RAM user expandable to 8MB
- 85MB hard disk drive
- 3.5" 1.44MB floppy disk drive
- MS-DOS 5.0 pre-installed
- 9.5" black-on-white VGA display
- 85-key full-travel keyboard
- Serial port, enhanced parallel port, video port, mouse/keyboard/keyboard port
- One internal modem socket
- NiCad battery for up to 3 hours* battery life
- 8.5" x 11" x 1.9" 6.5 lbs

New Lower Price

\$1599

Save \$200

*Battery life depends on application used, power management features selected and peripherals attached.

Call **Z•DIRECT** for
the only PCs that
come with all these
big names:
**Intel, Conner
and Jeffrey Crouch.**

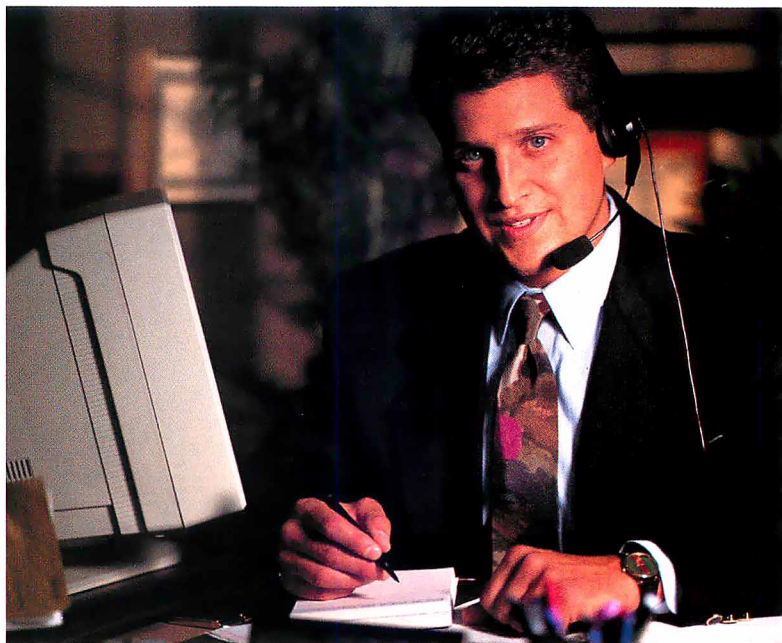
At Zenith Data Systems we believe you deserve nothing less than blue chip components. So for our PCs, we offer names like Intel for microprocessors and Conner™ for hard drives.



CONNER

And for customer assistance, we offer names like Jeffrey Crouch. Now while Jeff may not be top of mind today, one call and you'll never forget him. Because all our Z•DIRECT customer assistance reps are more than high tech trouble shooters, they're investment counselors.

They understand Z•NOTES and Z•STATIONS are designed for **integrated connectivity**, with an unprecedented ease and breadth of upgradability. It's what we call **investment protection**. With so many options for upgrading your investment available on the market today, the good advice of our



Customer Assistance Center can be a big help. Our Customer Assistance Center is ready to answer your questions Mon.-Fri., 7 AM to 11 PM (CST). Call **1-800-CARE-360**.

Jeffrey Crouch,
Z•DIRECT Customer
Assistance Center
Representative.

**"I'm more than
just your helpful
hardware man."**

All of which brings us to our renowned Z•CARE service. We think it's the best in the



business. Because we offer over **400 authorized service centers** in North America and more than **2,000 service reps** around the world.

With that kind of blanket coverage, you can enjoy on-site service for all our Z-STATIONS the next business day. There's 48-Hour Repair-and-Return or carry-in service for portables. And now Z-CARE offers **optional support upgrades** including network planning, start up, operation and expansion services. Even the com-

Z-DIRECT Customer Assistance Center.

Not just
troubleshooters,
investment
counselors.

petition finds our service exceptional. Because we're authorized to keep your network operational even if there is a variety of other PC brands or software in place. As for our competitors, they can only send you to "3rd party" service centers. But why go anywhere else when you can come to Z-DIRECT? Get Z series notebooks and PCs you want at a great low Z-DIRECT price—along with unrivaled Z-CARE service. That's what you can expect from the #1 name in SL portable computing.^{††}

**"Prices change rapidly.
Call for our latest and lowest."**

Z BEST service is Z-DIRECT.
1-800-289-1317

95%

**95% of calls
to the ZDS
Customer
Assistance
Centers
enjoy one call
problem
resolution.**



Z-SPORT™ 420S "High performance portable"

- Intel 20 MHz i486SX
- 85MB hard disk drive with MS-DOS 5.0 pre-installed
- 4MB RAM user expandable to 16MB
- 9.5" (V) black-on-white edgelit LCD 640 x 480 VGA with 64 grey shades, simultaneous video support
- 3.5" 1.44MB floppy disk drive
- 8.5" x 11" x 1.9," only 6.0 pounds
- Up to 2.5 hours battery life*
- 86-key keyboard with dedicated cursor and function keys
- Serial, parallel, external video, mouse ports
- Optional ZDS docking unit

New Lower Price

\$1999

Save \$550



Z-SPORT 425S "Powerful and portable"

- Intel 25 MHz i486SX
- 120MB hard disk drive with MS-DOS 5.0 pre-installed
- 4MB RAM user expandable to 16MB
- 9.5" (V) black-on-white edgelit LCD 640 x 480 VGA with 64 grey shades, simultaneous video support
- 3.5" 1.44MB floppy disk drive
- 8.5" x 11" x 1.9," only 6.0 pounds
- Up to 2.5 hours battery life*
- 86-key keyboard with dedicated cursor and function keys
- Serial, parallel, external video, mouse ports
- Optional ZDS docking unit

New Lower Price

\$2299

Save \$500

*Battery life depends on application used, power management features selected and peripherals attached.

You can't go wrong with our Buyer's Bill of Rights.

Buy Z•DIRECT for investment protection. Z series has unprecedented upgradability, integrated connectivity, ease of use and design. **Right** Buy Z•DIRECT for experienced direct sales consultants. No order takers at Zenith Data Systems. **Right** Buy Z•DIRECT for direct answers. 95% of your problems are solved in one call. **Right** Buy Z•DIRECT for direct, 48-hour shipment. **Right**

If it's not Z•DIRECT it's just not right.

Buy Z•DIRECT for no hassle returns. No questions asked, whatever the reason. Return your PC within 30 days.** **Right** Buy Z•DIRECT for direct technical support and a

complete array of direct-to-you peripherals, accessories and software. **Right**

*Based on advertised products as configured and availability.



Terms: MasterCard, Visa, Discover and American Express accepted. **No surcharge for credit card orders.** Money orders, certified checks, personal checks accepted (allow ten days for processing). Company and institutional P.O.'s upon credit approval. Prices do not include applicable sales tax, shipping and handling. Government, Education and Volume Purchase buyers please call for a quotation. Federal Government Sales please call 1-800/843-4131. **30-day money-back guarantee applies only when buying through Z•DIRECT. Excludes opened software and purchase which have been subject to abuse. Most notebooks include one-year limited mail-back warranty with optional Z•CARE service available (call, or see a Z•CARE contract for important details). †Based on ZDS price and manufacturer's suggested retail price for third party products. ††Source: International Data Corporation for 1991, published 10/92.

Order by FAX 1-800-472-7211. All products subject to availability. Specification and prices subject to change without notice. Zenith Data Systems is not responsible for typographical or photographic errors. Z•NOTE, Z•LITE, Z•SPORT, Z•STATION, READYDESK and LITEPOINT are trademarks and Z•CARE is a servicemark of Zenith Data Systems Corporation. MS-DOS and Microsoft are registered trademarks and Windows, LAN Manager, Windows for Workgroups and the Windows Ready-To-Run logo are trademarks of Microsoft Corporation. Intel is a registered trademark and i386, i486 and the Intel Inside logo are trademarks of Intel Corporation. Novell and NetWare are registered trademarks of Novell, Inc. Banyan and VINES are registered trademarks of Banyan Systems, Inc. Logitech and TrackMan are registered trademarks of Logitech, Inc. Conner is a trademark of Conner Peripherals, Inc. Copyright © 1993 Zenith Data Systems Corporation.



Z-425SX "Economical i486 value"

- Intel 25 MHz i486SX
- 4MB RAM user expandable to 40MB
- 170MB hard disk drive with MS-DOS 5.0 and Microsoft Windows 3.1 pre-installed
- Super VGA color monitor, 1024 x 768
- 3.5" 1.44MB internal floppy disk drive
- Mouse
- 5 open 16-bit ISA slots
- One 5.25" accessible drive bay
- One-year limited warranty

New Lower Price

\$1449

Save \$300



Z-433DX "Affordable i486 performance"

- Intel 33 MHz i486DX
- 4MB RAM user expandable to 40MB
- 170MB hard disk drive with MS-DOS 5.0 and Microsoft Windows 3.1 pre-installed
- Super VGA color monitor, 1024 x 768
- 3.5" 1.44MB internal floppy disk drive
- Mouse
- 5 open 16-bit ISA slots
- One 5.25" accessible drive bay
- One-year limited warranty

New Lower Price

\$1749

Save \$300

Now call Z•DIRECT
1-800-289-1317



ZENITH DATA SYSTEMS

A Bull Company

Thinking Ahead.

COMDEX: BIGGER THAN EVER

The Fall Comdex show last November was a combination of good news and bad news. The bad news was the logistical nightmare that occurred when a record crowd of 140,000 converged on Las Vegas. If you were at the show, you had to spend a good deal of time waiting: waiting for a taxi, waiting for a bus, waiting for a room in a hotel.

But the good news far outweighed the bad. Comdex presented us with a record number of interesting new products. For four years now, we have been helping show attendees by highlighting the most interesting products on display—the Best of Comdex. This year, despite the efforts of 16 editors, the assortment of interesting new products made our job the hardest it has ever been.

Energy Efficiency



The first category is Best System. This category seems to be dying off of late, being supplanted by Best Portable. But this year we saw a number of impressive new systems.

The winner of the Best System Award is a bold new prototype shown by IBM. The system did not even have a real name yet, being called a “Low-End Energy-Efficient Desktop Prototype,” but it is sure to have a huge impact on the industry. It consists of a small system unit (about the size of—dare I say—an IBM PCjr), a keyboard, and a 10½-inch active-matrix LCD color monitor. The system unit uses a 3.6-volt IBM version of the 486SX chip. It has four PCMCIA slots and consumes a total of only 30 watts. This low power consumption means it doesn’t need a fan and can even be placed inside a desk drawer. Still just a “technology demonstration,” this new system may appear as a product in the first half of this year.

The other finalists in the Best System category are both workstations. The DEC Alpha AXP, another prototype due early this year, is the first implementation of a personal computer based on DEC’s Alpha chip, a very-high-performance RISC microprocessor.

The other finalist, the Sun Sparcclassic, sports a price tag of \$4295 (\$3995 in quantities of 12 or more), making it the lowest-priced color workstation on the market. It is the first system to use the new low-cost microSPARC chip developed by Texas Instruments and Sun.

The Best Gets Better



In the category of Best Portable, it seems the best just got better. Last year, an Apple Mac PowerBook was deemed the Best Portable. This

year, the winner is the new Mac PowerBook Duo systems, which comprise a lightweight notebook, a docking station, and Apple’s PowerLatch cableless docking technology (see “New Macs for the Desktop and Road,” December 1992 BYTE). On the road, the Duo is a 4½-pound notebook. On the desktop, the Duo fits into a well-designed docking station that provides access to large displays, networks, expansion slots, and other peripherals.

The other finalists in the Best Portable category are both penpads. The first is the EO Personal Communicator, a \$2000 lightweight penpad system that offers sophisticated communications options, including a cellular-phone attachment.

And you can’t mention penpads without somehow bringing up Grid—in this case, the Grid Convertible (see “Is It a Penbook or a Notebook?,” December 1992 BYTE, page 60). In this penpad, the pen-input screen folds down over a standard keyboard, so you can use either input device as appropriate.

Fax by Remote



The Best Peripheral category was dominated by a newcomer, Macronix (San Jose, CA, (408) 453-8088). Its product is the Vomax 2000, an advanced messaging system for the home or office. This device features all the capabilities of a digital answering machine and data/fax modem, yet it uses only a single phone line. The Vomax’s remote retrieval feature lets you access both voice and fax messages from remote locations. If you need to be notified immediately, the Vomax can automatically transfer voice and fax messages or alert you via a pager.

Of course, you can’t think of peripherals without thinking of monitors. We picked the Nanao Flexscan 15-inch monitor as a finalist in the Best Peripheral category. This

The surprisingly large array of interesting new products at Comdex made it harder than ever to select the best



\$899 monitor features a unique automatic power standby mode that qualifies it for the U.S. EPA Energy Star Program (see "A Window to Windows," January BYTE, page 62).

The other finalist is National Semiconductor, with its TyIN 2000 fax card. The company's first consumer product combines business audio, data, fax, and voice-mail capabilities with an expandable DSP (digital signal processor), all in a single \$279 card (see "A National Voice for the PC," page 67).

Best Printer

There was such a strong selection of printers at the show that we started a new category for them. But that caused another problem: We could not select the single best printer. Thus, we picked two of them: the Hewlett-Packard LaserJet 4 and the IBM Color Jetprinter.

The LaserJet 4 and 4M printers (see "A New LaserJet, a New Standard," December 1992 BYTE) are sure to reinforce HP's leadership position in the laser-printer market. They feature a RISC processor and a 600-dot-per-inch resolution, yet they're aggressively priced at \$2199 and \$2999.

The \$3495 IBM (Lexmark) Color Jetprinter PS 4079 uses a four-color ink-jet process to produce vibrant colors on coated paper, envelopes, transparencies, and plain paper at sizes of up to 11 by 17 inches. With its simultaneous hot ports and automatic emulation switching, it can fit smoothly into mixed environments.

The remaining finalist in the Best Printer category is the Kyocera Ecosys aSi FS-3500A. This new version of Kyocera's award-winning Ecosys printer uses the same incredibly durable amorphous silicon drum, but it's almost twice as fast, at 18 pages per minute.

Best Software

Despite a surprisingly strong array of new software at the show, selecting the Best Software winner was relatively easy. Microsoft Access (see "Microsoft's Windows Database," December 1992 BYTE) combines the user interface of Visual Basic with a new programming language called Access Basic, making it easy to create powerful database systems. As if that weren't enough, Microsoft gave the product an incredibly low introductory price of \$99.

The other finalists in this category are Adobe Photoshop for Windows 2.5 and the interesting Visio from a new company called Shapeware. Photoshop, the preeminent Mac software package, has finally been moved over to Windows and comes complete with all the features of the re-

cently released Mac version.

Visio is a Windows graphics program with a twist; but more about that later.

Best Multimedia Product

The toughest time we had was in the Best Multimedia Product category. Two products stood head and shoulders above the rest, but they had such similar strengths that it was impossible to choose between them. So we ended up naming both Apple QuickTime and Microsoft Video for Windows as winners.

On the Mac, QuickTime is already the standard for viewing digital video, animation, sound, and other dynamic information on your computer screen. With QuickTime 1.5, Apple has added support for Kodak's PhotoCD format, closed-captioned text, and higher-performance software-only playback. Apple has also released QuickTime for Windows, which lets you play Mac QuickTime movies under Microsoft Windows.

Meanwhile, Microsoft Video for Windows (see "Microsoft's Small-Screen Debut," December 1992 BYTE, page 56) is neither the first nor the only software technology for managing digital video, but it is sure to set the standard for digital video in the fast-growing Windows market. Dozens of developers are already racing to support it, which should result in a new generation of multimedia applications.

The remaining finalist in the multimedia category is Brown-Wagh, with its StudioMagic board. This \$495 PC board lets anyone do video editing on a PC.

Best Connectivity Product

Microsoft dominated another category, this time with its Windows for Workgroups (see "Windows for Workgroups," November 1992 BYTE). This product combines peer-to-peer networking functionality with exceptional ease of use. The program features network DDE, which lets applications exchange information across a network.

The other finalists in this category are WordPerfect Office 4.0 and a Xircom PCMCIA Ethernet card. The new version of WordPerfect Office will combine E-mail with group scheduling and calendaring for DOS, Windows, and Mac platforms. And the \$395 Xircom Credit Card Ethernet Adapter was the most significant and most practical of the many implementations of PCMCIA cards at the show.

Most Significant Technology

In a broad sense, three technologies at Comdex seemed to be almost omnipresent: the PCMCIA cards, local bus, and wireless communi-

cations. But several brand-new technologies were on the show floor. Our choice as the Most Significant Technology is Adobe's Acrobat. Acrobat lets you create documents on one type of system and send them to any other, where they can be read or printed with little loss in detail or resolution. Acrobat's foundation is its portable document format, a device-independent file format that can be read on many different types of systems.

The other two finalists in this category are Intel's Indeo and IBM's voice-recognition technology. Indeo is a software product that lets you play video on systems that lack special video hardware. Video quality is automatically adjusted depending on the available hardware. The Indeo technology will be incorporated into Apple QuickTime, Microsoft Video for Windows, and IBM OS/2 environments.

IBM showed three voice-recognition technologies at the show, but its speaker-independent continuous-speech-recognition technology was the best. Developed with Carnegie Mellon University, it lets an IBM RISC System/6000 or a 486DX-based PS/2 recognize speaker-independent continuous speech. The system has a vocabulary of 1000 words at a time, but new vocabularies can be substituted almost instantaneously. A beta version of a developer's kit for this technology is available for a price of \$3995.

Best Rookie

The best newcomer to Comdex was Shapeware (Seattle, WA, (206) 467-6723), a company founded by former Aldus executives. The Visio software for Windows is a graphics package with a difference. It lets "graphically challenged" businesspeople easily create flowcharts, schematics, and other diagrams using predefined stencils or templates. (See "Shapeware's Visio Draws a New Path," January BYTE, page 64.)

Best of Show

And finally, we had to choose the Best of the Best, our Best of Show Award. This honor was won easily by Adobe's Acrobat technology. We see this technology as having a far-reaching impact on the world of personal computing. If Acrobat delivers what Adobe says it will, it should touch the lives of every PC user. By helping to cut the wasteful use of paper, it should also help preserve resources, thereby touching the lives of everyone on the planet. ■

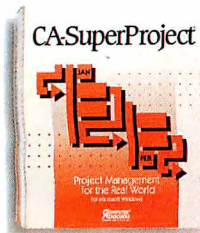
Rich Malloy is BYTE's executive editor based in New York. You can reach him on BIX as "rmalloy."

Introducing Power Windows For Project Managers.

The #1 Rated Project Manager Now Available For Windows.

Power changes people.

Especially project managers.

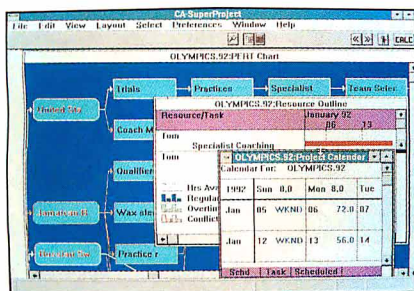


They're working smarter and faster with new CA-SuperProject® For Windows.

It's the world's most advanced, efficient and reliable project management software

— and now it's incredibly easy to use.

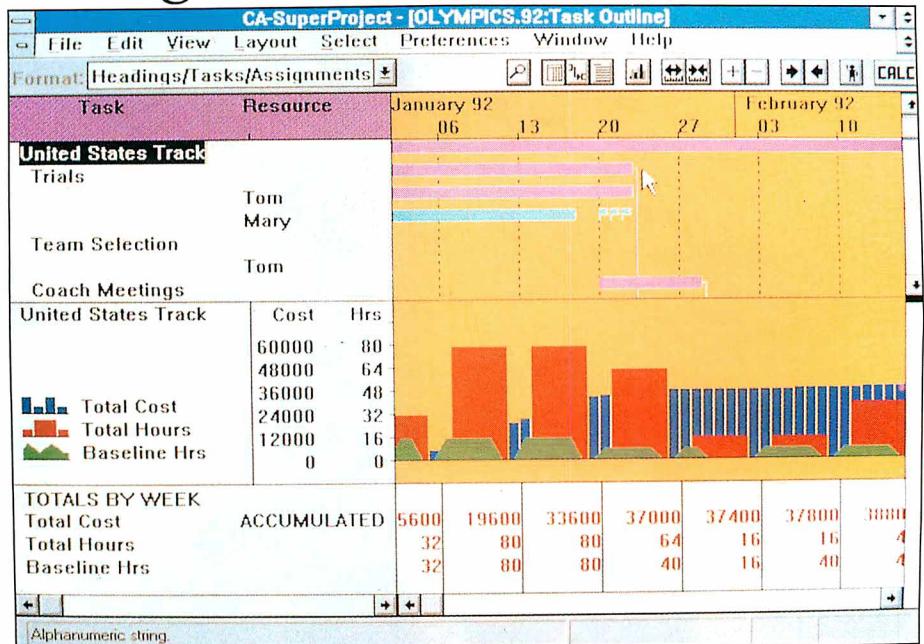
Total power is yours with just a few mouse clicks. Create and edit projects. Specify resources, task types and durations. Define integrated sub-projects. Build top-down hierarchies and task-



Report the status of your project with detailed Gantt, PERT, WBS and Cost/Resource charts.

dependency relations. Link multiple projects together for cross-project leveling. Perform extensive "what-if" analysis, revising schedules as projects progress.

You can bet your career on its



Manage with power, using tools for sophisticated planning, comprehensive resource management, tracking and controlling.

advanced and efficient scheduling algorithms.

A recent study of the five leading project managers proved it. Each was assigned the same



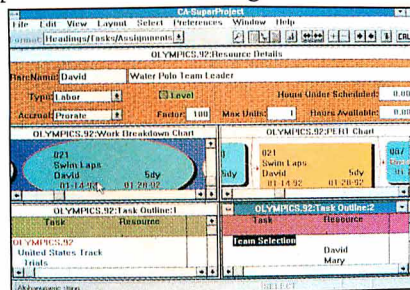
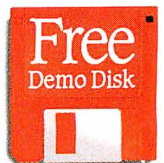
ing days—leaving Microsoft Project, Timeline 4.0, Project Workbench and Project Scheduler in the dust.

There's also a wide array of state-of-the-art graphics and detailed reporting tools to help bring your projects to life.

For your free Demo Disk, call 1-800-CALL CAI. Call today.

And find out what our power windows can do for you.

COMPUTER ASSOCIATES
Software superior by design.



Show multiple views of the same project or different projects simultaneously.

project, but the finish dates varied by as much as five months. CA-SuperProject For Windows finished first in 214 work-

CA-SuperProject® For Windows

© Computer Associates International, Inc., One Computer Associates Plaza, Islandia, NY 11788-7000. All product names referenced herein are trademarks of their respective companies.

Circle 75 on Inquiry Card.

IT CAN TURN A ONE-ON-ONE PRESENTATION INTO

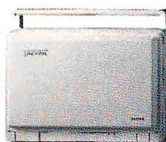


T 6 4 0 0 M M M O B I L E M U L T I M E D I A

STANDING ROOM ONLY.



Install an optional CD-ROM in place of the standard floppy drive or connect an external CD-ROM via an optional SCSI adapter. It's your choice.



The T6400 weighs 40% less than its competition, and the entire Mobile Multimedia System fits into a carrying case with wheels.



The T6400MM's full-motion video capabilities make presentations more memorable. Memorable presentations make sales go up.



Picture this:

You're giving your client a multimedia presentation. You're showing charts, you're showing graphs, you're showing a full-motion video of your product and you're accompanying all of this with CD-quality stereo sound.

Oh, and you're on the road. Off-site. With nothing but a portable computer.

Presenting Toshiba's latest achievement, the T6400MM Mobile Multimedia System—a road-ready multimedia package that provides all you need to make your next presentation a major media event.

Specifically: the acclaimed Toshiba T6400DXC portable (featuring a 10.4" LCD TFT active matrix color screen), which we've endowed with a pre-installed MediaShare Mambo® DVI card, HSC Interactive and VideOLÉ software, Windows® 3.1, a Logitech trackball mouse, and two Altec Lansing speakers.

Of course, if your needs don't extend to multimedia, you can purchase the T6400DXC (or the monochrome T6400DX) separately. With features like a 50MHz i486® DX2 processor, 200MB hard drive, full-length expansion slot and full-function 101-key detachable keyboard, you can practically impress your clients with its spec sheet alone.

To see what we mean, just call us at the toll-free number listed below. We'll direct you to your nearest Toshiba dealer for a presentation of the T6400MM's remarkable abilities.

But be forewarned: there could be quite a crowd surrounding it.

In Touch with Tomorrow
TOSHIBA

1 - 8 0 0 - 4 5 7 - 7 7 7 7

SYSTEM

© 1993 Toshiba America Information Systems, Inc. The Intel logo and i486 are trademarks of Intel Corporation. All symbols are trademarked and/or registered by their respective manufacturers.

Circle 144 on Inquiry Card.

COREL SCSI!

The Best Software to Connect PC Peripherals



Connect up to Seven Peripherals!

It's easy! Add all the SCSI devices you need to your system. CorelSCSI makes it simple and inexpensive. CorelSCSI provides you with all the software you need to install and manage all your SCSI devices including: CD-ROM drives, rewritable and WORM optical drives, hard drives, jukeboxes, tape drives, and many more.

► Unlimited Flexibility!

CorelSCSI software works with major SCSI host adapters including: Adaptec, Always, BusLogic, D.P.T., and Future Domain. CorelSCSI will allow installation of SCSI devices on DOS, Windows or OS/2 systems. CorelSCSI software will even allow you to set up CD-ROMs, optical drives or jukeboxes on your NetWare* file server!

* Novell Netware 386 v3.x and higher.

► "With its low cost and vast array of device support, CorelSCSI provides a great new way for PC users to make easier peripheral connections."

M. Keith Thompson, PC Magazine, June 1992

► **Compatible host adapter companies:**



► Value Packed!

CorelSCSI software includes bonus programs and utilities such as CD-Audio, Corel Tape Backup software, and complete diagnostic tools.*

► Quick Installation!

CorelSCSI software is quick and easy to install and will get you up and running immediately. CorelSCSI will ask what devices are connected and install the correct drivers automatically.

If you have CD-ROM drives, tape drives, or any other SCSI devices, you need CorelSCSI!

\$99 (US)
suggested list price



Look for the CorelSCSI Approved Product logo.



Circle 77 on Inquiry Card.

1-800-836-SCSI

CDNTEL: (613) 728-8200 FAX: (613) 761-9176



COMPUTERS ITALIAN STYLE

MILAN—Few people know that one of the biggest computer shows in the world, Smau, is held in Italy. Smau was hot, crowded, noisy, and big. In terms of hall space, Smau is larger than Fall Comdex and is second only to the Hannover CeBIT show. For such a big show, it is remarkable how few of the exhibitors are Italian hardware and software manufacturers.

IBM and Olivetti account for about half the sales in the Italian PC market, with the other half split three ways. One-third goes to big U.S. vendors (e.g., AST Research, Tandon, Compaq, and Zenith). Another third consists of large European PC vendors. The final third goes to the no-name box shifters who simply rebadge technology from Taiwan and Hong Kong.

Olidata is an Italian company of some note. It began life in 1982 as an accounting software house developing products for Olivetti systems. In 1986, it broke with Olivetti when it saw an opportunity to import cheap PCs from the Far East.

Olidata, based in Cesena, sells all its machines through dealers. Adolfo Savini, Olidata's marketing manager, points to the fact that there are some 90,000 dealers in Italy (around 10 times the number in the U.K.). Every village has someone who acts as a dealer. Olidata currently sells only in Italy, but it has plans to enter the U.K. market through a joint venture.

Hantarex is one of the world's biggest monitor suppliers, making everything from terminal screens to video walls. The monitors are manufactured in Florence and Milan. The Florence factory is a fully automated, robotic production facility making in excess of 1500 monitors a day. The majority of Hantarex's monitors are sold through OEM channels. Olivetti, IBM, AT&T, and Siemens all use Hantarex monitors. Hantarex also has its own PC brand, called Vegas. It has recently attempted to cut costs by moving its nontechnical production to Hungary, where Hantarex claims the labor is cheaper than in either Hong Kong or Taiwan.

In Italy, U.S. software dominates. DOS, Windows, OS/2, and various flavors of Unix are the only operating systems you see, and all the major application areas are dominated by Lotus, Microsoft, and WordPerfect.

One ray of light is the Baveno-based Italian Software Agency. It produces a Clipper CASE tool that was intended initially just for the Italian market. Its success has led the company to announce an English version. The product is called dBsee (for database software engineering environment), and it generates Clipper code auto-

matically through a neat user interface. The English-language version of dBsee should be available by the time you read this.

Perhaps one reason why there is little Italian software is that nobody seems to buy it. In the U.S., the average number of software licenses sold per PC (excluding the operating system) is between two and three. In Italy, for every three PCs sold, just one software package is sold. The Business Software Association estimates that if software usage is at U.S. levels, developers are losing about 700 billion lire (\$700 million) in Italy.

The BSA tries to stop piracy, but the Italian law is not strong or quick enough to make prosecution easy. According to Enzo Mazza of the BSA, the only solution is education. He has launched an "I love original software" campaign, which he believes has had some effect. Cynics however, suggest that it is a problem for all southern Europe, a problem that will be solved only if software is protected.

After a few days in Italy, you realize that what your PC looks like is more important than you'd think. Olivetti, for example, is redesigning its whole range to capture the designer market. In fact, one Olivetti director implied that he didn't care what I thought about the technical specification of its Quaderno subnotebook—the company was selling it as a *fashion accessory*, not a tool.

That said, it was with some amusement that I perused the entries in the Smau Best of Show Design Awards. Although Olivetti had a smattering of nominees, most awards went to gadgets designed outside Italy. Although Italians consider style important, they recognize the value of innovation from other countries. ■

Andy Redfern is BYTE's former U.K./Europe bureau chief. You can reach him on BIX as "aredfern."

The Italians love computers with style but crave innovative products from around the world



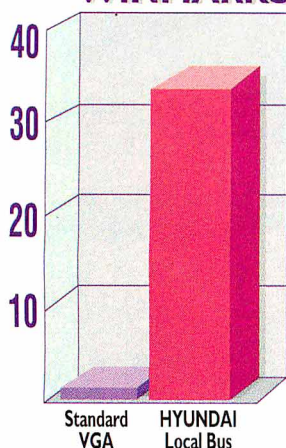


486 STAMPEDE



That thunder you hear on the PC prairie is the New Breed Hyundai 486 stampede. The hardest-charging, price-lean, MIPS-mean herd of computers you'll ever see. We're bringing everything from powerful 66MHz 486DX2 machines to Overdrive-Upgradable 486SX-25 computers. And with our 50MHz 486DX2 desktop PC and 486DX-33 blasters, you can handle today's demanding applications.

WINMARKS



Do something "Longhorn" Local Bus.

That flash you see on the graphics horizon is the image of our Windows processing power triggering the Hyundai 486 stampede.

Your 486 processor was meant to run today's applications. So why rein in all that power? That out-to-pasture, 16-bit VGA card can only deliver 2 Megapixels at best. That's already dated technology. Let her rip with 32-no-blink-bits of "Longhorn" Local Bus video acceleration. And with up to 32 Megapixels standard, believe it, you'll see an incredible difference in Windows performance.

Do something thunderbolt.

Lightning-fast "warpspeed" L2 caching is another max-performance feature that's designed into every Hyundai 486. Thunderbolt write-

back operations blast your DOS, Windows, or OS/2 data into a box canyon of ultra-fast SRAM. Start out with 128KB standard (more than the cow computers), then expand to 256KB to handle today's big applications. Cache hit for cache hit, the Hyundai 486 Family, with 128KB standard caching, delivers twice the MIPS of non-cached cows.

Do something upgradable.

The Hyundai 486 New Breed Family is designed in Silicon Valley, U.S.A., to out-perform the herd.

All of our systems are CPU-upgradable through a single chip via a ZIF or Overdrive socket, so the New Breed lets you double your speed. We won't let tomorrow's 32-bit operating systems blast a hole in your productivity. Just upgrade your Hyundai 486 to any higher-speed Intel 486 CPU in the future.





486SX/33-\$1999

This Hyundai 486SX-33 can out-muscle those barnyard bovines of cow country. But you be the judge.

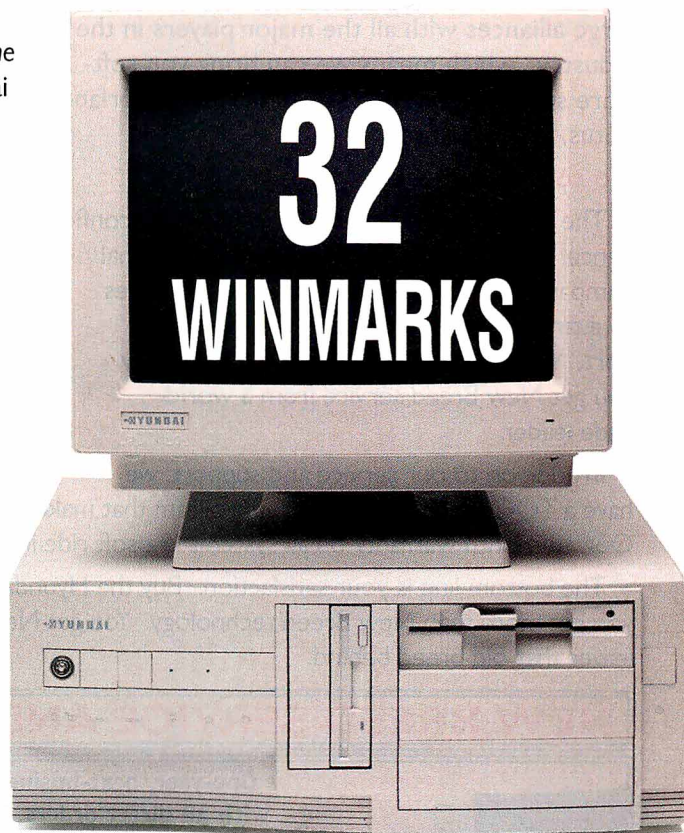
Our 32 Megapixel "Longhorn" Local Bus?... or a 1 Megapixel moo cow? Our "faster-than-a-blink" Windows accelerator video processing tied to the speed of your 486 CPU?... or an old-fashioned bottleneck? Our 1MB VRAM controller producing 1024 x 768 ultra-high, non-interlaced resolution?... or their tired cow VGA? Clearly, the prize goes to the Hyundai New Breed.

Compare our standard 128KB of zero-wait state cache with non-cached cows. And don't forget, the Hyundai 433S flexes its processing muscle up to 256KB of cache expansion. This system runs at the head of the stampede!

And we don't just drive the Hyundai stampede, we overdrive it! Double your speed by simply snapping in the Intel Overdrive™ Processor. And our advanced "warp-speed" L2 cache and "Longhorn" Local Bus graphics engine give your upgraded system the 32-bit video and fast SRAM you'll need for your higher-speed 486 CPU.

Hyundai 433S

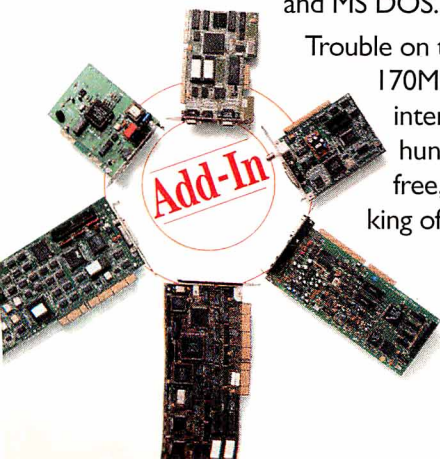
- 33MHz 486SX w/ 8KB integrated cache
- 32-bit VESA local bus UVGA graphics w/1MB VRAM
- 128KB "warpspeed" write-back 20ns SRAM L2 cache (expandable to 256KB)
- Upgradable to 486DX power via Intel "Overdrive" socket
- 4MB system memory expandable to 64MB on system board
- 170MB 19ms IDE HDD, 32KB disk buffer
- 1.44MB 3-1/2" and 1.2MB 5-1/4" FDDs, (2.88MB-ready FDD interface)
- 14" non-interlaced, ultra-high resolution, .28 dot pitch, 72Hz refresh rate, flicker-free, color display w/1024 x 768 resolution, tilt and swivel base
- 25/1P, integrated PS/2 mouse port
- 5 external drive bays, 2 internal
- 7 expansion slots, including 1 VESA local bus slot
- 200 watt power supply
- 101 keyboard, 2 button mouse
- Built-in virus protection, front keylock, 2 level password
- MS DOS 5.0 and MS Windows 3.1



Hyundai 433S

Want to talk add-ins? We test our 486 systems with literally hundreds of industry-standard cards and software applications. We test software compatibility on Novell (we're fully certified and a Novell Alliance Program member), Banyan Vines, OS/2 2.0, LAN Manager, and SCO UNIX, plus hundreds of programs running under Windows and MS DOS.

Trouble on the data frontier? Relax. The Hyundai 433S is loaded. A beefy 170MB superfast hard disk, two floppy drives, five external/two internal drive bays, and seven expansion slots mean you won't go hungry for performance. And dressed up with our 14" flicker-free, non-interlaced, color display, the New Breed 433S is the new king of PC country.



HYUNDAI
PCs designed and built in America

FOR DIRECT SALES
1-800-933-3445

Circle 86 on Inquiry Card (RESELLERS: 87).

DO SOMETHING EXTRA

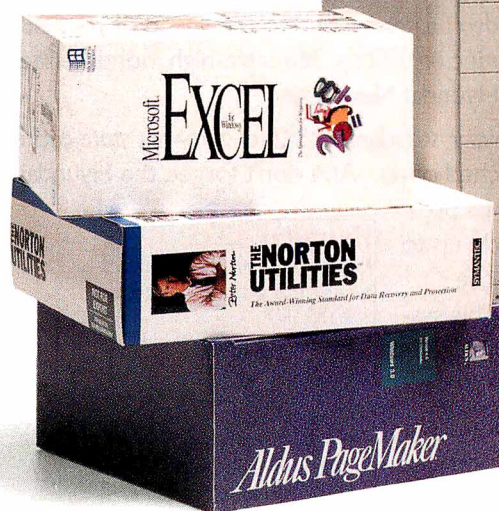
We'll give you more than you bargained for. When you go with the 486 stampede, from our 425SP to our powerhouse 466D2TE, we give you exclusive *low prices on software*. Our size and reputation allow us to forge alliances with all the major players in the industry, which means we can bring you software specials from firms like Microsoft, Borland, Lotus, and Symantec.

Do something safe.

The PC range war can shake everybody's confidence. Except ours. We're a \$50 billion global company, which means we have the resources to guarantee outstanding service and support. When you buy New Breed technology, you get New Breed service from a world-wide leader.

In addition to our service and support, we have a TQC (Total Quality Care) program that makes us the double-safe buy. Our 18-month warranty on all systems is a soft ride in the saddle.

The bottom line is your satisfaction. Buy the Hyundai 486 stampede, and you get more than New Breed technology. You get New Breed Service that leaves that old breed behind.



Great deals on optional software!

Hyundai 466D2TE New Breed Power Server

- 66MHz 486DX2 CPU w/8KB integrated cache
- 128KB high-speed L2 cache
- 32-bit EISA architecture
- 8MB RAM standard (expandable to 32MB on system board and 96MB via memory expansion board)
- 32-bit caching SCSI host adapter
- 360MB 12ms SCSI HDD, 256KB disk buffer
- 1.44MB 3-1/2" and 1.2MB 5-1/4" FDDs
- SVGA graphics card
- 14" interlaced, ultra-high resolution, flicker-free, color display with 1024 x 768 resolution, .28 dot pitch, 72MHz refresh rate
- Seven 32-bit EISA slots, one ISA slot
- 5 external and 2 internal drive bays
- 300 watt power supply
- Built-in virus protection, front keylock, 2 level password
- 101 keyboard, 2 button mouse
- MS DOS 5.0 and Windows 3.1

\$3995

NEW BREED SERVICE AND SUPPORT



- One-year, next-business-day, on-site service with all direct orders, followed by 6-month, ship-in warranty on parts and labor.
- 30-day, no-risk, money-back guarantee on anything you buy direct from Hyundai.

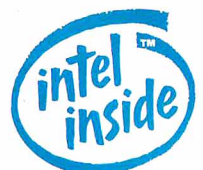
- 48-hour turnaround on ship-in repairs.
- Beginners Help Line: 800-933-9917.
- Product spec fax: 800-723-4843.
- 7-days-a-week tech support:
 - 24-hour lifetime tech support: 800-289-4986.
 - 24-hour tech fax: 800-283-4986.
 - 24-hour tech bulletin board: 800-955-5432.
 - Tech support through CompuServe access.

24 HRS. 7 DAYS.

HYUNDAI

PCs designed and built in America

FOR DIRECT SALES | -800-933-3445





POWERFUL



\$1799 Hyundai 425S

- 25MHz Intel 486SX w/8KB integrated cache
- 32-bit VESA Local Bus UVGA graphics w/1MB VRAM
- 128KB "warpspeed" write-back 20ns SRAM L2 cache (expandable to 256KB)
- Upgradable to 486DX power via Intel Overdrive™
- 4MB system memory expandable to 64MB on board
- 80MB 17ms IDE HDD, 32KB disk buffer
- 1.44MB 3-1/2" and 1.2MB 5-1/4" FDDs

- 14" non-interlaced, ultra-high resolution, .28 dot pitch, 72Hz refresh rate, flicker-free, color display w/1024 x 768 resolution, tilt-and-swivel base
- 25/1P, integrated PS/2 mouse port
- 5 external drive bays, 2 internal
- 7 slots incl. 1 VESA Local Bus slot
- 200 watt power supply
- 101 keyboard, 2-button mouse
- Built-in virus protection, front key lock, 2 level password
- MS DOS 5.0 and MS Windows 3.1
- Other hard drive, video, memory, and monitor options available



\$2369 Hyundai 433D

- 33MHz Intel 486DX w/8KB integrated cache
- 32-bit VESA Local Bus UVGA graphics w/1MB VRAM
- 128KB "warpspeed" write-back 20ns SRAM L2 cache (expandable to 256KB)
- Processor upgradable via ZIF socket
- 4MB system memory expandable to 64MB on board
- 200MB 12ms IDE HDD, 256KB disk buffer
- 1.44MB 3-1/2" and 1.2MB 5-1/4" FDDs
- 14" non-interlaced, ultra-high resolution, .28 dot

- pitch, 72Hz refresh rate, flicker-free, color display w/1024 x 768 resolution, tilt-and-swivel base
- 25/1P, integrated PS/2 mouse port
- 5 external drive bays, 2 internal
- 7 slots incl. 1 VESA Local Bus slot
- 200 watt power supply
- 101 keyboard, 2-button mouse
- Built-in virus protection, front key lock, 2 level password
- MS DOS 5.0 and MS Windows 3.1
- Available in floor-standing server model as 433DT, call for price
- Other hard drive, video, memory, and monitor options available



\$2599 Hyundai 450D2

- 50MHz Intel 486DX2 w/8KB integrated cache
- 32-bit VESA Local Bus UVGA graphics w/1MB VRAM
- 128KB "warpspeed" write-back 20ns SRAM L2 cache (expandable to 256KB)
- Processor upgradable via ZIF socket
- 8MB system memory expandable to 64MB onboard
- 200MB 12ms IDE HDD, 256KB disk buffer
- 1.44MB 3-1/2" and 1.2MB 5-1/4" FDDs

- 14" non-interlaced, ultra-high resolution, .28 dot pitch, 72Hz refresh rate, flicker-free, color display w/1024 x 768 resolution, tilt-and-swivel base
- 25/1P, integrated PS/2 mouse port
- 5 external drive bays, 2 internal
- 7 slots incl. 1 VESA Local Bus slot
- 200 watt power supply
- 101 keyboard, 2-button mouse
- Built-in virus protection, front key lock, 2 level password
- MS DOS 5.0 and MS Windows 3.1
- Other hard drive, video, memory, and monitor options available



\$2995 Hyundai 466D2

- 66MHz Intel 486DX2 w/8KB integrated cache
- 32-bit VESA Local Bus UVGA graphics w/1MB VRAM
- 128KB "warpspeed" write-back 20ns SRAM L2 cache (expandable to 256KB)
- Processor upgradable via ZIF socket
- 8MB system memory expandable to 64MB on board
- 360MB 12ms IDE HDD, 256KB disk buffer
- 1.44MB 3-1/2" and 1.2MB 5-1/4" FDDs
- 14" non-interlaced, ultra-high resolution, .28 dot

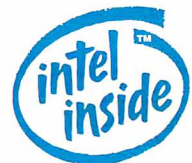
- pitch, 72Hz refresh rate, flicker-free, color display w/1024 x 768 resolution, tilt-and-swivel base
- 25/1P, integrated PS/2 mouse port
- 5 external drive bays, 2 internal
- 7 slots incl. 1 VESA Local Bus slot
- 200 watt power supply
- 101 keyboard, 2 button mouse
- Built-in virus protection, front key lock, 2 level password
- MS DOS 5.0 and MS Windows 3.1
- Available in floor-standing model with ISA architecture as 466D2T, call for price
- Other hard drive, video, memory, and monitor options available

DO SOMETHING SMART. CALL HYUNDAI DIRECT SALES.

HYUNDAI
PCs designed and built in America

1-800-933-3445

BYT-103



166 Baypointe Pkwy, San Jose, CA 95134 Hours: 6AM-5PM PST M-F

We accept MasterCard, Visa, money orders, certified checks (allow 10 days for processing), CODs, approved company and institutional purchase orders, and wire transfers. All return items must be accompanied by a return merchandise authorization (RMA) number. Opened, defect-free software is non-refundable. Prices and product descriptions are subject to change without notice. Hyundai is not liable for damage due to omissions or typographical errors. All trademarks are the property of their respective companies. The Do Something logo is a trademark and Do Something New Breed is a registered trademark of Hyundai. © 1992 Hyundai Electronics America. All rights reserved.

Circle 86 on Inquiry Card (RESELLERS: 87).

Lotus Improv for Windows

KENNETH M. SHELDON

Lotus's Improv spreadsheet builds and automatically applies formulas

from more traditional spreadsheets—such as Excel, 1-2-3, and Quattro Pro—the results are fascinating, and Improv is sure to influence the future development of the spreadsheet.

Itemizing Your Data

Ordinary spreadsheets organize data into rows and columns. Improv, on the other hand, looks at data as *items*. Instead of A, B, C and 1, 2, 3, Improv uses item labels, such as "Territory" and "Sales." Cells that in traditional spreadsheets would have

Two years ago, Lotus Development introduced Improv, a radically different kind of spreadsheet (see "What's NeXT After 1-2-3?," October 1990 BYTE). The problem with Improv was that you needed a Next computer to run it—which meant that most of us couldn't. Now, Lotus has released Improv for Windows. Although it may not lure advanced users away

names such as "C3" become "Eastern Region:Q1," and a typical spreadsheet range such as "A3..A15" becomes the more meaningful "Jan..Dec" in Improv.

To create a formula with Improv, you just point and click on the appropriate items. Improv builds the formula in a *formula pane* that is attached to the bottom of the worksheet and applies it to all items that are appropriate. (Of course, if you're a masochist, you can still enter your formulas manually from the keyboard.) While other spreadsheets may let you name cells, ranges, and formulas, the procedure is not set up as an integral part of the structure, as it is with Improv, and is nowhere near as easy.

Screen 1 is a worksheet for a doughnut company, with three categories of items: Region, Year, and Flavor (a subcategory of Region). To see Region as a subcategory of Flavor (so you can tell where plain doughnuts sell best), you just drag and drop the Flavor *tile* (a button in the lower left of the window) in front of the Region tile. Improv instantly rearranges the data (see screen 2). Drag the Year tile to the upper left of the windows, and Improv places each year on a separate page, which you can flip through by clicking on the page icons. Each of these pages is a *view* of the underlying model. Improv lets you create as many as 16 different views and then choose among them using a *browser* window.

Improv formulas are smart (note that the formula for Grand Total of doughnuts sold is smart enough to ignore subtotal Jelly Total), as well as being general-purpose. To create the doughnut spreadsheet using a typical spreadsheet application would require 28 formulas, each existing in a separate cell. Improv uses just three formulas.

A Windows View

In porting Improv to Windows, Lotus adopted the overall Windows look, as well as many of the features that are becoming standard to that environment. For instance, a row of SmartIcons lets you perform common actions at a click of the mouse, and a status bar at the bottom of the window gives you information about the current selection. You can customize the SmartIcons palette, even adding your own icons to which you attach macros to automate repetitive tasks.

If you don't like the SmartIcons or status bar, you can simply hide them. And a

		1991	1992	Total Sales	
East Coast	Jelly	Raspberry	100	80	180
		Lemon	75	70	145
		Avocado	2		
		Total Jelly	177		
	Chocolate	225			
	Plain	250			
	Tofu Crunch	5	4	9	
Grand Total		657	657	1314	
West Coast	Jelly	Raspberry	55	75	130
		Lemon	45	50	95
		Avocado	150	175	325
		Total Jelly	250	300	550
	Chocolate	200	225	425	
	Plain	35	30	65	
	Tofu Crunch	200	225	425	
Grand Total		685	780	1465	

Region

Flavor

+

1

Total Sales = :1991 + :1992

2

Flavor.Grand Total = groupsum (Jelly .. Tofu Crunch)

Formula Overlap

Click to change formula priority

C:\IMPROV\MODELS

Print

Calc

Screen 1: Improv's worksheets organize your data by items, letting you create subcategories within an item.

click of the right mouse button on a Smart-Icon brings up an explanation of that icon. (Elsewhere in Improv, clicking on the right mouse button brings up a menu of actions that are appropriate to that particular object, such as changing the color, font, or justification.)

To create a chart in Improv, you select a worksheet (or range) and click on the Create Chart icon. Improv automatically creates a bar chart (although you can easily change the program so that a different style of chart is created) and lets you add colors and titles and hide elements, as well as many other options. Improv reverses the usual worksheet-chart relationship: Rather than place a chart directly on a worksheet, you add a *hotview* (essentially a copy of the worksheet) to a chart. Any changes you make to the worksheet are immediately reflected in all charts and hotviews.

Improving Your Old Worksheets

Improv's features make it easy to create new worksheets. But what about worksheets that you've created with other applications?

Improv will import worksheets from Lotus 1-2-3 (including the new release 3.4), Excel, and a variety of other formats, and you can tell it to use the row and column labels as item names. As Improv imports a spreadsheet, it filters cells that contain formulas and converts them to Improv formulas. Also, Improv alerts you if any of the formulas didn't make the trip successfully.

Unfortunately, due to the difference in the way a traditional spreadsheet organizes data, you may have to do a fair bit of massaging to get your Improv worksheet to look right. And if you need to import a 3-D spreadsheet, things get even trickier. In my tests with a beta version of Improv, I was able to import some (but not all) of the Excel worksheets I tried, and formulas containing references to other worksheets were lost.

Improv maintains multiple spreadsheets as pages of a single worksheet or as several worksheets in a single *model*. You can link worksheets in a model by pointing and clicking to create *intersheet formulas*. To link worksheets not in the same model—or those in other applications—you must use DDE or OLE links.

Aside from the issue of importing data, Improv has just a few interface quirks, such as the lack of a button to automati-

Lotus Improv - [Sales - By Flavor - DONUTS]

File Edit Create Worksheet Tools Window Help

			1991	1992	Total Sales
Jelly	Raspberry	East Coast	100	80	180
		West Coast	55	75	130
	Lemon	East Coast	75		
		West Coast	45		
	Avocado	East Coast	2		
		West Coast	150		
	Total Jelly	East Coast	177	153	330
		West Coast	250	300	550
Chocolate	East Coast	225	250	475	
	West Coast	200	225	425	
Plain	East Coast	250	250	500	
	West Coast	35	30	65	
Tofu Crunch	East Coast	5	4	9	
	West Coast	200	225	425	
Grand Total	East Coast	657	657	1314	
	West Coast	685	780	1465	

DONUTS.IMP - C:\IMPROV

BakedGoods - View1	
Sales - ByFlavor	
Sales - ByRegion	
Sales - ByYear	

Flavor	Region	+
--------	--------	---

✓ 1	Total Sales = :1991 + :1992
✓ 2	Flavor.Grand Total = groupsum (Jelly .. Tofu Crunch)
	overlaps formula 1

Formula Overlap Click to change formula priority C:\IMPROV\MODELS

Screen 2: Improv's smart formulas let you rearrange your items simply by dragging and dropping a tile.

cally resize columns to fit cell contents. Nor can you add blank lines to a worksheet for appearance's sake. And while Improv can automatically assign label names (e.g., duplicate an item called "Jan," and Improv will automatically label the next items "Feb," "Mar," and so on), this feature doesn't work as well as Excel's auto-fill feature: Create the labels 1, 3, and 5, and Improv will label the next item 6, unless you explicitly spell out the steps in a Data Fill dialog box.

A New Species of Spreadsheet

The development of the spreadsheet is surely a case of punctuated evolution: gradual improvements marked by occasional dramatic changes. Just as VisiCalc was overwhelmed by the speed and charting abilities of Lotus 1-2-3, 1-2-3 has lately been challenged by spreadsheet programs better adapted to the world of graphical interfaces.

In spite of a few minor quirks, Improv is a major advance in the spreadsheet metaphor. It is probably the easiest spreadsheet for novices to learn, and even old hands may find the traditional spreadsheets they're used to working with to be inflexible and hidebound once they've played with Improv. Now that Improv has mi-

grated to the Windows world, the effect on the rest of the spreadsheet community should be very interesting. ■

Kenneth M. Sheldon is a consulting editor for BYTE specializing in new computer technologies. You can reach him on BIX as "ksheldon."

THE FACTS

Improv for Windows
\$495

System requirements:

A 386SX or higher with VGA, a mouse, DOS 3.31 or higher, Windows 3.1, 4 MB of RAM, and a hard disk with up to 12 MB of free space.

Lotus Development Corp.
55 Cambridge Pkwy.
Cambridge, MA 02142
(800) 343-5414
(617) 577-8500
fax: (617) 693-1197

Circle 1167 on Inquiry Card.

FoxPro 2.5 for DOS and Windows

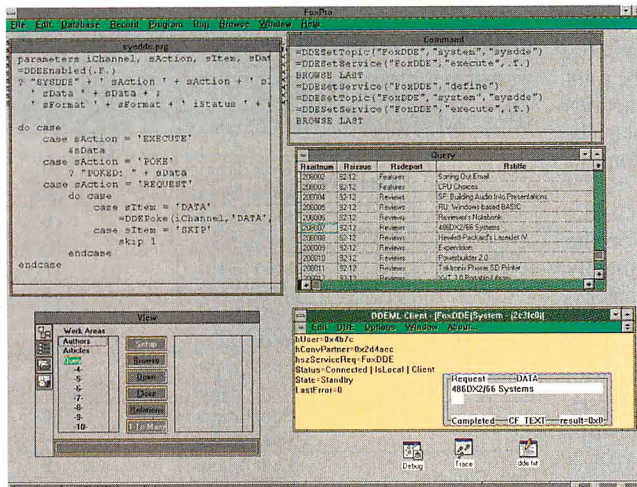
Like many FoxPro users, I rejoiced in the speed and power of the blockbuster version 2.0. I worked hard to develop a multiuser FoxPro application that would enable BYTE's DOS, Windows, Mac, and Unix users to share data on our LAN. Clearly, I should have paid more respect to Murphy's Law. The challenge of merging three code bases into a common core made the vision of multiplatform FoxPro painfully slow to materialize. The simultaneous release of **FoxPro 2.5 for DOS and for Windows** represents two giant steps in the right direction.

Both are high-performance multiuser products that can share not only common data, but also common FoxPro application code.

My first test of FoxPro for Windows was, of course, to rebuild and run my biggest version 2.0 application. It worked, but what appeared in the upper-left quadrant of my 1024- by 768-pixel Windows display were ugly caricatures of my carefully designed FoxPro 2.0 screens. By default, FoxPro for Windows presents DOS-defined screens using a monospace OEM font, squashed controls, and lines and boxes made from characters rather than Windows graphics.

To perform a Windows face-lift, you edit the screen's underlying database (its .SCX file) using the FoxPro for Windows screen builder. It spawns a tool called the *transporter*, which automatically duplicates each screen-definition record, tags one member of each pair for DOS and the other for Windows, and assigns default fonts, sizes, and positions to the Windows elements. When you generate code from that screen database, you're actually creating two similar programs wrapped up in a giant case statement. At run time, one of those branches will execute depending on whether the system variable `_DOS` or `_WINDOWS` is true.

While the automatic treatment yields true Windows screens, I had to fiddle a lot with color, size, style, and placement to make my screens look good. I'd rather not repeat the exercise for the Mac and then for Unix. A more intelligent transporter could simplify that chore. Even then, there would be another wrinkle. Automatic bracketing of code for multiple platforms requires use of the screen builder and code generator. I



use these tools for all static interface elements, but I've tended to hand-code dynamic elements such as pop-up menus. Now I'll have to test for `_DOS` or `_WINDOWS` (or, soon, `_MAC` or `_UNIX`) in each of these cases and code variations for each platform. I'd hoped to avoid that. If DOS is my reference platform, I shouldn't need to make exceptions for Windows.

Conversion hassles aside, there's a lot to like about FoxPro for Windows. A 32-bit application built on Watcom's Windows extender, it runs single-table queries briskly and blows away version 2.0 on multitable queries. There are plenty of Windows goodies as well. The new GENERAL data type holds sounds, pictures, and other objects that are dished up by OLE servers.

FoxPro's DDE support is spiffy. I was delighted by how easily I made FoxPro play the role of a DDE server that could receive SQL queries from DDE clients, execute the queries, and poke back results. Other Windows enhancements include odometer-like "spinner" controls, functions that call the Windows common font and file dialog boxes, and the ability to drag and drop lines in the text editor. The beta version I tested wasn't able to call DLLs from FoxPro code or use ODBC (Open Database Connectivity) to fetch foreign data—two features Microsoft says will appear in the shipping product.

If it weren't for all the new toys in FoxPro for Windows, I'd be tempted to stick with its DOS counterpart. Like version 2.0, it comes in 16- and 32-bit versions. The latter, which is now built on Phar Lap's DPMI (DOS Protected Mode Interface)-compliant DOS extender, coexists

with the DOS 5.0 and Windows 3.x memory managers and is also screamingly fast. I won't benchmark formally until both version 2.5 products ship, but it looks like the 32-bit DOS product will leave the 32-bit Windows product in the dust. Because it can now also run under Windows, the DOS product merits serious consideration even in Windows-centric environments. What you gain with the DOS version is speed and freedom from multiple-platform maintenance. What you lose, though, is the ability to stir the spicy FoxPro ingredient into a rich stew of

Windows applications.

How does FoxPro for Windows compare to Access? It depends. If I had to target only Windows, I'd go with Access, which is smoother than FoxPro's initial Windows port. Access's intrinsic SQL is also more appealing than FoxPro's layered, read-only SQL. I'd favor FoxPro for raw speed, however, particularly with huge databases. And, of course, I still hope to deliver my FoxPro application to Mac and Unix users. FoxPro's multiplatform strategy isn't as refined as I'd like, but it looks workable. Murphy willing, I'll find out for sure later this year.

—Jon Udell

THE FACTS

FoxPro 2.5 for Windows FoxPro 2.5 for DOS

\$495 each

System requirements:

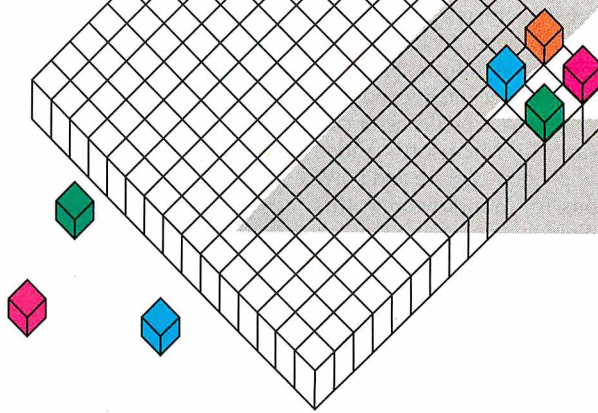
Hardware (DOS): A 286 for the 16-bit version; a 386 with 2 MB of RAM for the 32-bit version.
Hardware (Windows): A 386 with 4 to 6 MB of RAM.
Software: DOS 3.1 or higher; Windows 3.0 or higher.

Microsoft Corp.
1 Microsoft Way
Redmond, WA 98052
(800) 426-9400
(206) 882-8080
fax: (206) 936-7329
Circle 1169 on Inquiry Card.

**Now
\$520 Off**

the purchase of all 3 products until April 6/93.
Offer covers C Set/2, WorkFrame/2 and
Toolkit when purchased together.
List \$995.00. Dealer price may vary.

Work Set/2



Powerful New Tools for OS/2 Programming

The WorkFrame/2 product ... because the best environment for application development is the one you create yourself.

With WorkFrame/2, you can integrate your choice of development tools – including those for DOS and Windows. It's open, configurable and language independent. And it's easy to customize the WorkFrame/2 interface to create your own development environment.

The concept is simple. WorkFrame/2 organizes files into logical units called projects. By associating each project with your personal choice of compiler/debugger/linker/editor you can get the greatest productivity possible from all your development tools.

The C Set/2 product ... because application development should be fast – and simple!

C Set/2 delivers a one-two punch to help you create some of the fastest-performing OS/2-based applications possible.

First, the 32-bit C compiler enables your applications to exploit the speed and power of 386- and 486-based computers. It's the best high-performance code optimizer in the business. With the C Set/2 compiler, unsafe optimizations simply don't exist.

Second, C Set/2 comes with a fully interactive, full-function, source-level 32-bit Presentation Manager debugger. Just point your mouse and shoot, using the graphical PM user interface – or use the keyboard.

Either way it's easy. And you'll get instant feedback on the screen to verify what you're doing. Debugging has never been so simple!

And there's more. The C Set/2 compiler conforms to industry standards – including ANSI C and ISO/IEC – and offers Microsoft C compatibility. With features like a full suite of run-time libraries and 32-16 bit linkage, you can be sure C Set/2 will provide the function and flexibility you need to make application development fast and simple – the way it should be.

**OS/2 2.0 Developer's Toolkit ...
because it takes the right set of tools
to build powerful applications.**

OS/2 2.0 Developer's Toolkit is the perfect companion to use with C Set/2. It contains a variety of language-independent application build and productivity tools. For the C Set/2 compiler, Toolkit provides the system linker and system header files. It also contains the import libraries and the NMAKE utility you need to dramatically increase the capabilities of C Set/2 to build powerful applications.

To order or get more information on how IBM application development tools can work in your OS/2 environment,

in the USA call **1-800-342-6672**

in Canada call **1-800-465-7999**

Making good things happen in application development...



IBM, OS/2, and Presentation Manager are registered trademarks, C Set/2 and Workframe are trademarks of International Business Machines Corporation. Windows is a trademark of Microsoft Corporation.

Circle 88 on Inquiry Card.

Windows Video Flows

SuperMatch, the part of SuperMac Technology that creates products for PCs, has done itself proud. Its latest product, **VideoSpigot for Windows**, brings to Windows users the image quality and ease of installation that its Mac predecessor carries. Built to run with Microsoft's Video for Windows, the video-capture and playback extensions for Windows 3.1, this newest VideoSpigot offers some key advantages that other video-capture boards don't have.

VideoSpigot for Windows is a single board with no jumpers or DIP switches. It occupies one interrupt—being a 16-bit board, it can be placed above IRQ (interrupt request) 7—and one 8-KB region of memory. That 8-KB relocatable buffer became a favorite of mine from the very beginning. When I looked at the beta version of Video for Windows (see "Microsoft's Small-Screen Debut," December 1992 BYTE, page 56), I was stymied by the inability of the capture boards that are supported by that release (including Video Blaster and Super Video Windows) to run in my system with 16 MB of memory installed. I had to get one of the PCs from BYTE's Multimedia Lab, a Uniq 486/50, *downsized* to 8 MB to accommodate the overlay boards.

Now I can get the Uniq system decked out again, because VideoSpigot's memory buffer can be located either below the 1-MB mark or in upper memory around the 15- to 16-MB area (which is where overlay boards typically go). VideoSpigot's installation dialog box has a "Scan" button that will hunt for a free 8-KB hunk of memory. Even though it failed to find any such free memory on my system, it worked fine when I gave it a handpicked address to search for.

Unlike most other current Windows digitizers, this board is *not* a video-overlay board. Its only lot in life is digitizing, and that's a plus. Because this board doesn't expect to be cabled to a VGA adapter's feature connector (as video-overlay boards do), you can use VideoSpigot with any kind of display you like. Overlay boards often get cranky in Super VGA modes, and they can get really cranky (read that as "stop working") at high resolutions. You can run an overlay board without its VGA connection, but the video often comes in misaligned because the VGA mode you're using can't be sensed. In contrast, VideoSpigot doesn't care what display you're using—just as long as you're using a Win-



dows-compatible display board, you're in business.

Aside from all this, VideoSpigot's key advantage is the quality of its capture. The board uses extremely high quality digital-encoding hardware. SuperMac claims VideoSpigot will capture 30 frames per second at the standard 160- by 120-pixel window size and 15 frames per second at the 320- by 240- pixel window size. While I verified that it did indeed move faster than my Video Blaster, it was difficult to get a reliable measurement because of all the conditions that affect capture speed (disk fragmentation, disk cache, and memory are key variables).

When it comes to playback time, the board steps out of the way; there is no hardware acceleration of either the display or decompression. SuperMac has its own compressor/decompressor software that it claims does the standard set provided by Microsoft one better. This software plugs in as a Windows driver and offers higher compression ratios. In addition, according to SuperMac, it also offers better-looking video.

As with other Windows capture boards, the audio that accompanies your video is digitized through a separate connection to an MPC-compatible sound card. VideoSpigot connects to both composite and S-Video (Y/C) video devices through ports on the back of the card. Only one input is

active at a time, and the capture driver lets you select an input manually or else senses which connection has an active signal and selects it for you.

VideoSpigot will be bundled with a collection of software from Asymetrix, including Multimedia ToolBook, Make Your Point, and MediaBlitz. A video editor isn't part of the bundle because a third-party editor (à la Adobe Premiere for the Mac) for Windows doesn't exist yet; Video for Windows does include some limited editing capabilities. VideoSpigot's ease of installation and use, relatively low cost, high-quality color, and enhanced compression software make it as obvious a choice for Windows users as it has been for Mac users.

—Tom Yager

THE FACTS

VideoSpigot for Windows \$499

SuperMac Technology
485 Potrero Ave.
Sunnyvale, CA 94086
(408) 245-2202
fax: (408) 735-7250

Circle 1168 on Inquiry Card.

Microsoft BallPoint is
the only laptop mouse
that you can adjust to
four different angles.



BallPoint® mouse raises your comfort level several degrees. And its easy-to-see cursor lowers your frustration level just as much. The point being, if you use the Windows™ operating system on a laptop, BallPoint makes your work even easier. So call us at (800) 426-9400 to find out how to get one. Because next to this mouse, others are hard to handle.

Microsoft®
Making it easier

© 1992 Microsoft Corporation. All rights reserved. Printed in the USA. In the 50 United States, call (800) 426-9400. Outside the 50 United States, call (206) 936-8661. Customers in Canada, call (800) 563-9048. Microsoft and BallPoint are registered trademarks and Windows is a trademark of Microsoft Corporation.

Atari's Falcon030 Leads the Pack

While IBM, Apple, and others are expected to introduce computers with DSPs (digital signal processors) later this year, the first company to ship a low-cost PC with a DSP is none other than Atari—the video-game company that once hit \$2 billion a year in sales and then nearly collapsed in the mid-1980s.

Although Atari is smaller these days, it's still selling a line of computers. Atari's latest computer, the **Falcon030**, is a surprisingly versatile machine that points the way toward a new generation of multimedia computers. Given Atari's track record, it's hard not to be skeptical, but the Falcon really is something different.

Right out of the box, with no additional hardware required, you can attach the Falcon to a VGA monitor, a TV, a VCR, a camcorder, a stereo system, a pair of microphones, an electric guitar, a MIDI keyboard, or almost any audio/video device that accepts a patch cord. To add similar capabilities to any other PC would probably cost more than the price of the Falcon—\$799 for the basic unit with 1 MB of RAM and a 1.44-MB floppy drive.

With the right software, you can mix multiple sound sources, apply special effects, and record audio on either a tape recorder or the computer's hard disk. If you choose direct-to-disk digital recording, the Falcon supports eight-track, 16-bit stereo at sampling rates of up to 50 kHz, exceeding the quality of CDs and DAT (digital audiotape).

The Falcon is also adept at handling video and graphics. Built-in video supports 65,536 colors at 640 by 480 pixels, with 262,144 possible hues. The computer accepts an external video synchronization signal for genlocking, and a special overlay mode lets you add titling and special effects. Composite video and RF outputs are standard. It wouldn't take much to turn the Falcon into a low-cost video workstation.

What makes all this possible is the 32-MHz Motorola 56001 DSP, coupled to a 16-MHz 68030 CPU and a pair of custom coprocessors. The DSP is the most important component. DSPs excel at pro-



cessing fast streams of sampled analog data in real time, making them ideal for multimedia applications. Computers with DSPs can do a better job of manipulating music and speech, compressing sound and graphics, and communicating with analog devices. What's more, DSPs can work in the background, freeing the CPU for other tasks.

For example, the Falcon's DSP supports eight 16-bit DMA channels that operate in parallel, allowing simultaneous audio recording and playback. Standard audio interfaces include stereo I/O jacks and a pair of MIDI ports for attaching music keyboards and other MIDI devices.

Another port brings out the pins of the DSP bus. This makes the DSP accessible for a wide range of uses, including video digitizers and telecommunications. Also standard are a LocalTalk port for easy networking with Macs and a SCSI-2 port with DMA. The fast SCSI port is vital because the Falcon's internal 65-MB hard drive isn't nearly large enough for serious digital recording, which at CD quality gobbles up more than 7 MB per minute. With the SCSI-2 port, you can add as much storage as you can afford.

The Falcon runs a proprietary multitasking operating system and Digital Research's GEM. It's compatible with most

software written for Atari's earlier ST computers, including a wide variety of applications for business, desktop publishing, and entertainment. There's a particular abundance of music software, and some of it's being rewritten to take advantage of the Falcon's DSP. Only a few DSP-driven programs were available for this evaluation, however, and they were still unfinished.

One program I tested was Musicom. I plugged an electric guitar into the Falcon and used Musicom to add flanging, harmonizing, equalizing, digital delay, and heavy-metal distortion—replacing hundreds of dollars' worth of special-effects pedals. Next, I digitally recorded a rhythm track onto the Falcon's hard disk. I used Musicom to play back the rhythm guitar, mix in a lead guitar, and record both parts on a tape recorder. And I did all

this without any extra hardware.

Until now, the only desktop computers with integrated DSPs were the Next workstations, which also use the 56001 DSP from Motorola. IBM and Texas Instruments have developed a DSP called the MWave, which will appear in IBM's Ultimea computers later this year. Apple has adopted AT&T's DSP3210 for its future Macs. With the Falcon030, Atari is offering a tantalizing and affordable preview of things to come.

—Tom R. Halfhill

THE FACTS

Falcon030

with 1 MB of RAM and a 1.44-MB floppy drive, \$799; with 4 MB of RAM (expandable to 14 MB) and an internal 65-MB IDE hard drive, \$1299

Atari
1196 Borregas Ave.
Sunnyvale, CA 94089
(408) 745-2000
fax: (408) 745-4306

Circle 1170 on Inquiry Card.

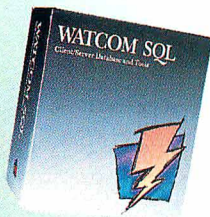
Programmer's Paradise®

WATCOM SQL Developer's Edition by WATCOM

Complete client/server development tool allows you to develop and deploy single-user standalone applications, and to develop applications for use with the Network Server Edition (sold separately). Includes: Single-user database server (both 16 and 32-bit versions); ACME application development system; Embedded SQL C/C++ preprocessor; SQL libraries for WATCOM C, C/386, MS/C++ and BC/C++.

List: \$395 Ours: \$299

FAX *cetera* # 1683-0010



HUGE SELECTION AT THE RIGHT PRICE! CALL TODAY!

386MAX	\$72	MKS Learning UNIX	\$99
Baler	\$399	MKS Toolkit	\$205
Bar Code Library	\$350	MS C/C++	\$309
Borland C++	\$319	MS Visual Basic	CALL
C Windows Tlkt. 386	\$179	Multi-Edit Professional	\$139
C++/Views	\$449	Norton Desktop/Win	CALL
C-DOC Professional	\$269	object-Menu	\$269
CAD/CAM Products	CALL	Opt-Tech Sort/Merge	\$119
CASE:W Corporate	CALL	OPTLINK	CALL
Clipper	\$499	OPTLINK/Compress	\$315
dBASE IV	\$499	Paradox 4.0	\$569
dBFast Windows	\$395	PGL	CALL
dGT-Unlimited Runtime	\$499	RTLink/Plus	\$445
Dr. Switch-ASE	\$159	RTPatch	\$69
GX Products	CALL	SlickEdit	\$149
KPWin++	CALL	SQA:Replay	\$79
Label Master	\$429	Turbo C++ for Windows	\$112
Lahey EM/32 5.0	\$1,015	WATCOM FORTRAN 77/386	\$719

Essential Graphics Chart™ for Windows by South Mountain Software

Essential Graphics Chart for Windows lets you turn your data into charts and graphs that make an immediate visual impact. Features include: DLL-works with any Windows API compatible language, 2D bar, 3D bar, legends for all chart types, real-time charts, true perspective and rotational capability. No Royalties.

List: \$399 Ours: \$299

FAX *cetera* # 2089-0017



INSTANT REPLAY PRO (IRPRO) 3.0 by Instant Replay Corp.

IRPRO is an authoring/development software system for the creation of: 1) Demo disks and software ads, 2) tutorials, training materials, CBT, 3) professional presentations: a) Laserdisk based, and b) computer managed slide shows. IRPRO manages the capture of audio, video, graphics, animations and compressed video for incorporation into your presentation.

List: \$795 Ours: \$599

FAX *cetera* # 1760-0001



CA-Clipper 5.2 by Computer Associates

Clipper is a comprehensive PC application development system for PCs offering network support, user extensibility, a replaceable database driver and executable file generation. An open architecture system. Clipper includes a robust language, pre-processor, compiler, linker, virtual memory manager, editor and debugger, and permits development of applications that are larger than available memory.

List: \$795 Ours: \$499

FAX *cetera* # 5400-0001



Q+E Database Library (QELIB) 1.1 by Pioneer Software

A set of Dynamic Link Libraries providing a common call level interface for developer tools such as Visual BASIC, ToolBook, Actor, Smalltalk, C, C++, etc. and most macro language products to access data from Oracle, SQL Server, Sybase, EE Database Manager, DB2, Netware SQL, dBASE, Paradox, Excel, and Text files.

List: \$399 Ours: \$359

FAX *cetera* # 2625-0002



Microsoft Windows for Workgroups by Microsoft Corporation

Considering how much easier one PC is to use with the MS Windows™ operating system, imagine what MS Windows™ for Workgroups can do for an entire group. Such as information sharing among many PC users that can lead to even better, more collaborative work. Printer sharing that uses hardware resources more efficiently. And schedule management that improves efficiency.

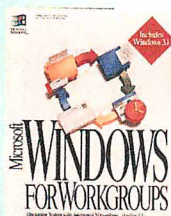
Workgroups List: \$249

ADD-On List: \$ 79

FAX *cetera* # 1269-0042

Ours: \$149

Ours: \$ 61



DESQview/X by Quarterdeck

Graphics, Multitasking, and Connectivity. DESQview/X is a stunning DOS graphic environment—just like MS Windows or OS/2. Run multiple programs at the same time using simple, intuitive icons, with an added benefit: The X-Windows, the international standard for graphical computing and distributed computing. This means DESQview/X can run programs remotely from other DOS PC's running DESQview/X, or UNIX X-Windows workstations, with point and click simplicity. Your networked resources can become transparently accessible from your PC. Also includes QEMM-386, Manifest, full compatibility with MS Windows, and the Adobe Type Manager. Call for details.

List: \$275 Ours: \$248

FAX *cetera* # 0027-3001



8

0

0

0

4

4

5

7

8

9

9

9

Software that Sizzles!



WATCOM C/386 9.0 by WATCOM

Develop and Debug 32-bit applications for extended DOS, Windows, and OS/2 2.0 with the most complete 32-bit C development package available. Includes the royalty-free DOS/4GW DOS extender by Rational Systems, components from MS Windows SDK, compiler, linker, debugger, profiler, plus numerous development tools. Supports other industry standard 32-bit DOS extenders. Create ADS Applications for AutoCAD or embedded systems development.



List: \$895 **Ours:** \$599
FAX_{cetera} # 1683-0001

Visio by ShapeWare

With Visio's™ intuitive drag and drop drawing, everyone can create professional-quality graphics. Straightforward stencils, designed for everyday business drawings and technical diagrams, provide all the shapes you need. Whether you're creating engineering schematics, network or block diagrams, org charts, programming flow charts, or your own custom drawings, Visio has a stencil of shapes that will make your job easier. **GET A \$79 VISIO PROGRAMMER'S STENCIL FREE WITH EACH COPY OF VISIO YOU ORDER!**



List: \$299 **Ours:** \$225
FAX_{cetera} # 1006-2801



WindowsMAKER Professional 4.0 by Blue Sky Software

Next generation of industry standard C/C++ development tool for Windows. The easiest fastest way to create Windows apps, just point and click. New architecture uses Switch-It™ Code Generation Modules for generating ANSI C, MFC++, or OWL C++ code among others. Award-winning Visual Prototyper lets you test the look & feel and make changes on the fly. TrueCode technology ensures the user code is preserved during

code regeneration. Generates Windows .EXE w/fully commented C or C++ source. CUA & SAA compliant.

List: \$995 **Ours:** \$695
FAX_{cetera} # 2602-0003

PRODUCT OF THE MONTH



Visual Basic for Windows by Microsoft Corporation

The fastest way to program for Windows just got faster. When you need to create a Windows application quickly, nothing offers the sheer productivity of Microsoft Visual Basic 2.0 Standard Edition. A visual development environment, flexible programming language, and fast runtime execution make this the shortest

route to full-featured Windows applications. The Professional Edition includes messaging and data access capabilities, a wide variety of add-on tools, and more.

Standard Edition	List: \$199	Ours: \$139
Professional Edition	List: \$495	Ours: \$337
FAX _{cetera} # 1269-0039		

ED-The Programmer's Editor by Lifeboat Software

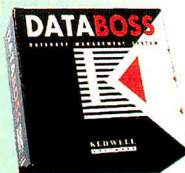
A full-featured windows based programmer's editor is here! ED is setting the standard with features like background compilation, automatic code indenting and completion, hyper-text function/procedure lookups, "smart" language-specific editing, a fast "C" extension language, Windows Toolbar, unlimited undo and redo, keyboard macros and remapping, and emulation of popular DOS editors (BRIEF, Wordstar, Qedit, Norton).



List: \$269 **Ours:** \$199
FAX_{cetera} # 0233-0011

DataBoss 3.5 by Kedwell Software, Inc.

Relational database application generator. Use to develop complete applications with menus, forms, browse tables, memo fields, reports and more. Includes sophisticated screen painter; field definition template for defining field characteristics, indexes, data files and their relations; WYSIWYG report designer; generator engine and skeletal files. Generates structured "C" or Pascal source code. No license or runtime fees.



List: \$695 **Ours:** \$529
FAX_{cetera} # 3758-0001



Microsoft Visual Basic for DOS by Microsoft Corporation

Award-Winning productivity—now available for DOS! Draw forms and controls, write event-procedures, use and create custom controls—in DOS! Create all-new apps or combine with existing C/C++ or Pascal code. Highly compatible with VB/Win for

multi-platform development. Even run existing MS Quick Basic/Basic PDS code! Includes a native 80 x 86 compiler that creates 100% standalone .EXE files, 386 code generation, MOVE overlays, an integrated ISAM and much more!

Standard Edition	List: \$199	Ours: \$139
Professional Edition	List: \$495	Ours: \$325
FAX _{cetera} # 1269-0039		



Lahey F77L-EM/32 by Lahey Computer Systems

Industry leading 32-bit FORTRAN Language System includes Phar Lap's 386/DOS Extender. VCPI, XMS, and DPMI compliant extender enables users to access up to 4GB and operate in the OS/2 and MS Windows DOS box. The extender is royalty-free and

includes virtual memory support. 5.1 includes Editor, profiler, make utility, library manager, video graphics and 486 optimizations. 90 new features including support for popular VAX and IBM VS.

List: \$1390 **Ours:** \$1015
FAX_{cetera} # 1476-0004

9
9
8
7
5
4
4
0
0
8

Programmer's Paradise[®]

MetaWare High C/C++ by MetaWare, Inc.

MetaWare, Inc. announces its newest product! The 32-bit High C/C++ compiler version 3.0 is a true compiler, not a C to C++ translator. "Incremental Strengths" let you specify the level of C++ compilation, allowing you to migrate from C to C++, one C/C++ block at a time. Included is a C++ tailored source-level debugger and a 32-bit Application Development Kit for Windows. MetaWare offers a full line of multi-language, multi-platform compilers for professional software developers.



List: \$795 Ours: \$669
FAX_{cetera} # 1590-0008

CA-dBFast Windows 2.0 by Computer Associates

The complete stand-alone dBASE/Xbase development language for MS Windows. Create fast, powerful, easy-to-use graphical applications. Over 200 extensions to the dBASE III PLUS language and includes an interactive editor, compiler, and linker. Challenge your creativity and imagination! Design multiple windows, pull-down menus, check boxes, list boxes, radio buttons, bit-map pictures, and more!



List: \$550 Ours: \$395
FAX_{cetera} # 1004-0003

Microsoft Test by Microsoft Corporation

MS Test for Windows makes comprehensive testing easier, reduces testing costs, and validates the quality of software as you write it. Deliver better applications for Windows in less time. Test the production version of any application for the Windows environment. Capture simple test scripts with a recorder or create sophisticated scripts in the TestBasic macro language. Reduce overall testing time and increase testing accuracy. Catch bugs faster and produce fully functional programs in less time, for lower overall development costs.



List: \$395 Ours: \$275
FAX_{cetera} # 1269-0035

QuickForm Contracts by Invisible Hand Software

An expert system for your PC that automates the drafting of fourteen categories of contracts most often needed by software developers and consultants. Prompts you with multiple choice questions and then automatically assembles a "near custom" agreement weighted to your side. QuickForms literally produces millions of variations of documents each in about 10 minutes. Port any document to your word processor for fine tuning by counsel.



Saves time, money and lets you hit the table first with a document weighted in your favor.

List: \$195 Ours: \$175
FAX_{cetera} # 3285-0001

BASIC Network Library Network C Library by Automation Software Consultants, Inc.

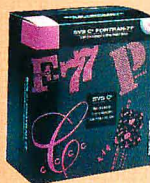
The most comprehensive libraries available for NetWare software development, supporting all versions of advanced NetWare including 3.11. Over 450 C functions and 300 BASIC functions. Include any features from the NetWare command line utilities and menu utilities in your C or BASIC program. No licensing hassles. C library source code available.



BASIC Library List: \$265 Ours: \$229
C Library List: \$295 Ours: \$259
FAX_{cetera} # 1004-9201

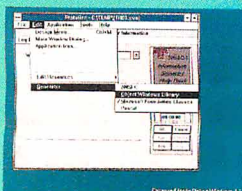
SVS C³/FORTRAN-77 by Silicon Valley Software Version V 2.8.2

SVS C³/FORTRAN-77 runs in and creates 32-bit executables for use with MS Windows 3.x as DPMI executables. Compiler, development tools and applications are DPMI conforming and support most VCPI requirements. Extensive



graphics and scientific function library is included. Executables are run-time royalty free.

List: \$395 Ours: \$356
FAX_{cetera} # 2863-0001



PROTOGEN 3.0 by ProtoView Development

NEW VERSION! The industry standard for code generation and prototyping Windows applications. Develop the user interface of your application using

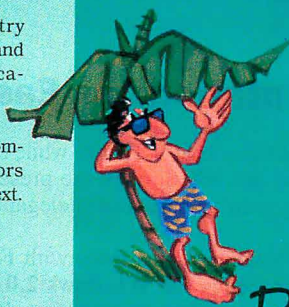
Visual prototyping methods. ProtoGen generates expert level, commented code for ANSI C, Microsoft NT Win32. All generators included! User Code is preserved from one generation to the next. It's easy and fast.

List: \$99 Ours: \$95
FAX_{cetera} # 2553-0002

GUARANTEED BEST PRICES! (Call for details)

To order call: 800-445-7899
Corporate (CORSOFT): 800 422-6507
FAX: 908 389-9227
International: 908 389-9228
Customer Service: 908 389-9229

**For more information on the products
featured on these pages call-
FAX_{cetera}®: 908 389-8173**



Programmer's Paradise[®]

• All prices are subject to change without notice.

Circle 95 on Inquiry Card.

8
0
0
4
4
5
-
7
8
9
9

QMS 1725: New RISC, Old Reliability

The network laser-printer market has never been a playground. But with intensifying pressure from relative newcomers such as Compaq and veterans such as Hewlett-Packard, QMS has found it necessary to update its powerhouse 17-page-per-minute QMS-PS 1700 with the **QMS 1725 Print System**.

Among the biggest improvements the 1725 offers is an Intel 25-MHz 960-CF RISC processor. With an on-board 4-KB instruction cache and 1-KB data cache, it's a step beyond the 960-CA of the 1700. This product is the first to use the CF chip, which Intel announced last May. And where the 1700 included Adobe PostScript Level 1, HP PCL4 (Printer Control Language 4), HPGL (Hewlett-Packard Graphics Language) 7475A/7550A, and CCITT Group 4 fax, the 1725 has repackaged and enhanced this PDL (page-description language) support.

In place of Adobe PostScript Level 1 is QMS PostScript Levels 1 and 2, emulations of PostScript that follow the Adobe specification. (QMS already offers this in the 8-ppm QMS 860 Print System it announced last summer.) PCL4 is also standard; QMS expects to offer PCL5 later. Emulations of Group 4 fax (often needed for compatibility with compressed files even though QMS PostScript Level 2 includes it) and HPGL are sold together on an optional (\$250) ROM card that plugs into one of two slots in the front of the unit. DECnet users can purchase an LN03 Plus emulation for the 1700 or the 1725.

From the outside, the 1725 looks identical to the 1700. Before adding the two 500-sheet paper trays, the unit is a whopping 106 pounds. The prerelease version I looked at was fitted with 32 MB of RAM (8 MB comes standard), a \$695 duplexing tray, a \$795 internal 40-MB hard drive, and 38 of the 39 resident fonts the shipping product supplies. The 1700 comes with 45 fonts.



What the 1725 shares with its predecessor is a wealth of features that have kept the QMS presence strong in the market. The 1725 owes part of its appeal to the Canon NX engine, also present in HP's LaserJet IIIsi, and its 50,000-page-per-month duty cycle. A generous helping of interfaces keeps your options open: serial, parallel, LocalTalk, and a fourth you can use to connect directly to Ethernet (i.e., NetWare, EtherTalk, TCP/IP, or a combination DECnet and TCP/IP) or NetWare on token ring.

These interfaces would add up to little if not for the Crown technology QMS uses in several models to off-load document-processing duties from the host computer. The 1725, for example, lets you adjust the size of the buffers you've devoted to each interface to match expected traffic. Each interface can thus accept data simultaneously, spilling it over to common printer RAM or even to one or more hard disks (you can install up to six, counting external devices connected through the 1725's SCSI port). As much as 255 MB of data, if necessary, can spill over to disk, where it's treated as RAM.

Another important part of Crown is ESP (Emulation Sensing Processor) technology.

A feature found in other vendors' products under different names, ESP analyzes incoming data and selects the appropriate language to keep you from having to switch settings in hardware or include software commands. A context-switching feature preserves the state of one emulation while you are using another.

Print jobs output alternately to the left and right edges of the 1000-sheet output tray to separate jobs. Multiple-copy runs are quickened through the 1725's storage of a page, in compressed form, in printer RAM to avoid the need for duplicative compilation and rasterization.

As for print quality, the 1725 offers 300 by 300 dots per inch or, for four times the dots for high-quality work, 600 by 600 dpi. Text output is crisp and legible even in small point sizes. Graphics images, notably at the higher resolution, are clean, and the curves are well delineated.

If the 1725 is any indication, anyone considering a printer for networks of up to 20 users may not have to look any further than QMS.

—Ed Perratore

THE FACTS

QMS 1725 Print System

\$5995

NetWare or EtherTalk
Ethernet interface, \$895
NetWare token-ring interface,
\$1095

QMS, Inc.
1 Magnum Pass
Mobile, AL 36618
(800) 631-2692
(205) 639-4400
fax: (205) 633-4866

Circle 1171 on Inquiry Card.

Making Presentations as Easy as 1, 2, 3

Lotus believes that many computer users who prepare presentations don't necessarily use presentation packages. Instead, they use word processors, spreadsheets, or other programs they're familiar with to produce overhead transparencies, slides, or handouts. As the old expression goes, "When all you own is a hammer, every-

thing looks like a nail." That is, while these tools may get you through the presentation, they aren't a particularly elegant solution.

One challenge Lotus faces with **FreeLance Graphics for Windows 2.0**, according to product manager Allison Parker, is getting people to use a presentation

package. This may sound odd, considering that the market is crowded with excellent programs. As with word processors and spreadsheets, software companies are adding features to keep a step ahead of the competition.

But presentation packages aren't the same as word processors and spreadsheets,

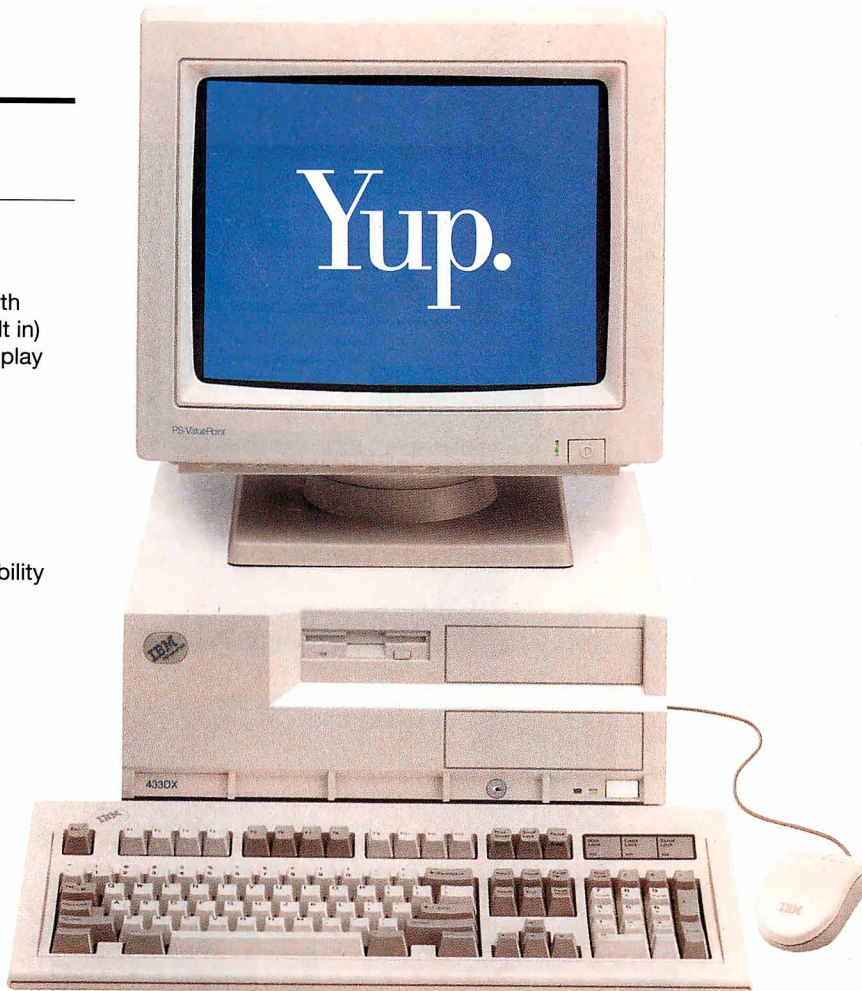
“You mean I can order
from IBM
over the phone?”



PS/ValuePoint™
433DX

i486™DX/33 MHz
120MB hard drive
8MB RAM
Pre-installed OS/2® 2.0 (with
DOS and Windows™ built in)
6312 SVGA NI 14" color display
3.5" diskette drive
IBM mouse
Internal i487™ math
coprocessor
128KB L2 cache
8KB internal cache
1MB Video DRAM
Industry standard compatibility
Networkable
5 slots/5 bays

\$1,999*



Welcome to IBM Direct.



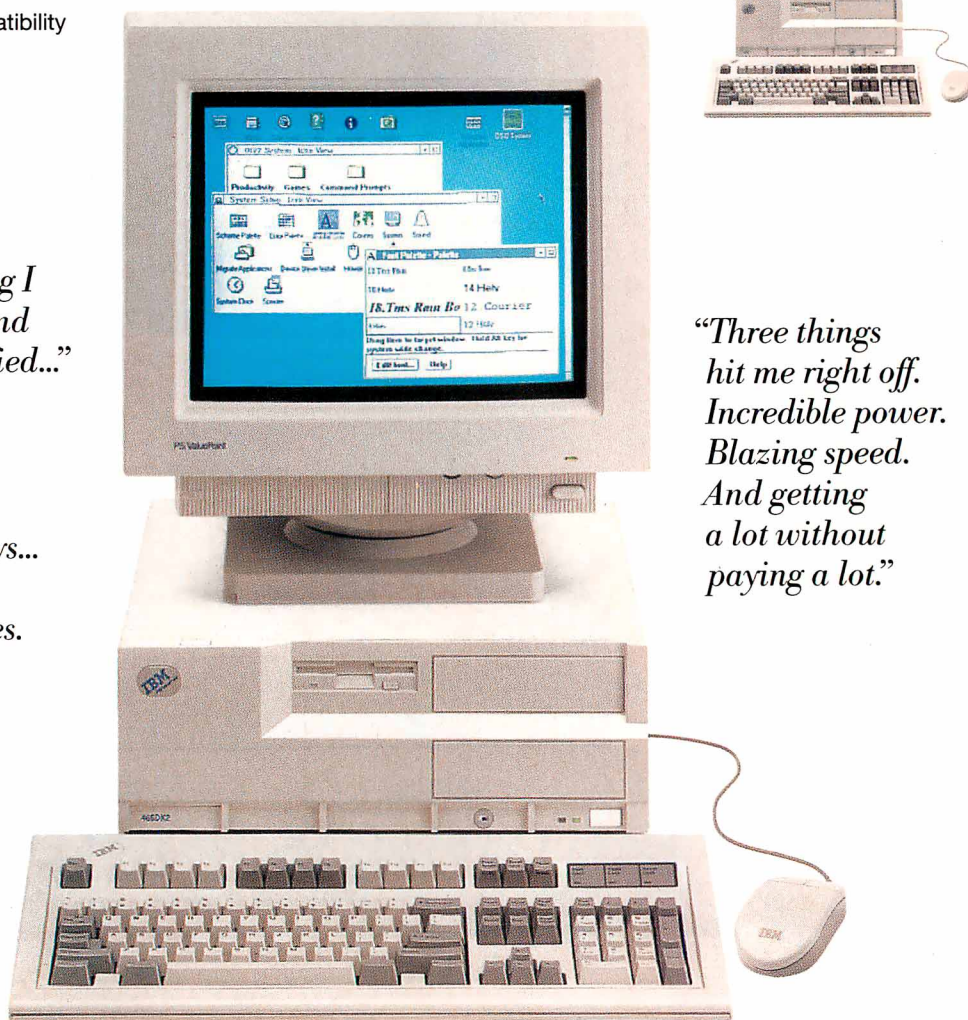
PS/ValuePoint 466DX2

i486DX2/66 MHz
212MB hard drive
8MB RAM
Pre-installed OS/2 2.0 (with
DOS and Windows built in)
6319 SVGA NI 15" color display
3.5" diskette drive
IBM mouse
Internal i487 math coprocessor
128KB L2 cache
8KB internal cache
1MB Video DRAM
Industry standard compatibility
Networkable
5 slots/5 bays

\$3,119*

*"It's everything I
need now...and
Novell®-certified..."*

*"It's not just
slots and bays...
It gives me
lots of choices.
And that
feels great."*



PS/ValuePoint 325T

386SLC™/25 MHz
80MB hard drive
2MB RAM
Pre-installed DOS 5.0
PS/2® 8511 VGA color display
3.5" diskette drive
IBM mouse
5 slots/5 bays
IBM enhanced keyboard
Industry standard compatibility

\$1,299*



*"Three things
hit me right off.
Incredible power.
Blazing speed.
And getting
a lot without
paying a lot."*

Every detail says IBM,

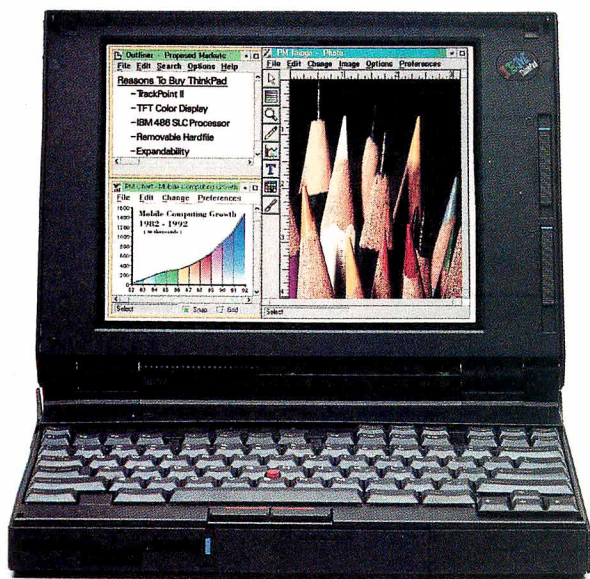


ThinkPad™ 700C†

486SLC/25 MHz
120MB hard drive
4MB RAM
DOS 5.0 and PRODIGY®††
pre-installed
10.4" active matrix
color display
3.5" diskette drive
TrackPoint II,™ an integrated
pointing device
Full-size keyboard, 84 keys
NiMH rechargeable
battery pack
Removable hard disks
Slip-in IC DRAM cards
for memory
Up to 16MB memory, system
maximum

\$4,139*

*"No more mice
scurrying
around...This
TrackPoint II
is one hot
little button."*



ThinkPad 300†

386SL/25 MHz
80MB hard drive
4MB RAM
DOS 5.0 pre-installed
Integrated STN LCD display
3.5" diskette drive

\$2,335*



IBM Direct

Buy IBM by phone.

Quality, service, selection and price—just call IBM Direct. It's that easy to get IBM PC products delivered right to your door. Or for more information on IBM products, call our automated fax system at 1 800 426-3395.

Choose the best way to pay.

Easy payment methods—American Express, VISA, MasterCard, Discover card or personal check. Personal checks are subject to credit approval. Purchase order is available for qualifying customers.



Hundreds of IBM products.

The IBM Direct catalog highlights a broad range of other products such as application software, storage devices, memory options, connectivity adapters and much more. In addition, our 40-page catalog features other IBM PS/ValuePoint and ThinkPad configurations. And if you want a PS/ValuePoint system with DOS and Windows only, that is also available on certain configurations.

The HelpWare™ Advantage.

- One-year, on-site warranty for PS/ValuePoint products and ThinkPad 300.
- Three-year international warranty for ThinkPad 700 and 700C (in U.S., first year on-site).
- 24-hour 800# assistance, 7 days a week¹
- 4-hour service response time, on average²
- 24-hour Bulletin Board and Automated Fax
- Hassle-free, 30-day money-back guarantee³
- Plus 10,000 IBM service representatives at 1,600 locations backed by a \$1 billion parts inventory

¹ At no additional charge during warranty.

² Available Monday through Friday 8 am-5 pm in your time zone, when serviced by IBM. If parts are required, this service is provided after receipt of parts shipped overnight. Applies to IBM Direct sales only.

³ Warranty and 30-day guarantee information available from IBM and IBM authorized dealers. Please call 1 800 426-2968 for details regarding IBM's money-back guarantee and limited warranty. Copies of the terms of IBM's money-back guarantee and limited warranty are available upon request.

*"Wow! It's the
biggest color
screen I've ever
seen."*

* IBM prices only. The offerings, prices and products are subject to change or withdrawal without prior notice. Products you acquire may not be counted under any existing Volume Purchase Agreement. The same offerings and products may be available through IBM Authorized Remarketers. Remarketer prices may vary. Shipping and handling charges are extra.

¹ ThinkPad 300 and 700C systems and options are manufactured in Japan. PS/ValuePoint 6312, 6314 and 6319 Color Displays are manufactured in Korea.

¹¹ PRODIGY will not run without a modem. A modem is not included with the ThinkPad 700C. A customer who acquires the ThinkPad 700C and a modem which operates at a speed below 9600 bps may contact Prodigy to obtain a One-Month Free Trial Membership.

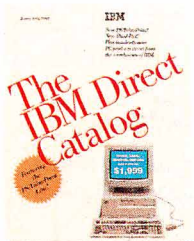
When calling, please
reference X213BYTE.

except the price.

**CALL TO ORDER TODAY
1 800 IBM 2YOU**

1 800 426-2968 8am-9pm EST Monday-Friday

"And with one phone call I can get all this, too?"



Catalog

For handy reference and comparison shopping, the IBM Direct Catalog is a comprehensive source for a broad range of products available through IBM Direct.

Free



IBM LaserPrinter

An IBM LaserPrinter 6 delivers up to 6-pages-per-minute performance, 300 dpi resolution for sharp images, and a variety of built-in type fonts.

\$1,510*

You bet. And much more. This page offers just a sampling of the more than 250 advanced technology products IBM Direct offers to help you keep pace with your changing computer needs. From IBM desktops, ThinkPads and displays to adapters, peripherals, software, network connectors, even multimedia options. Just give us a call. We'll be glad to guide you to the IBM products most appropriate for your needs. We can also provide you with accurate specifications and answer any questions you may have.

ThinkPad 700 and 700C Options

	Price*
Data/Fax Modem (2400 bps/9600 bps)	\$285
IBM PS/2 8MB IC DRAM Card	\$905
IBM ThinkPad 486SLC2 Processor Upgrade	\$549

ThinkPad 300 Options

Data/Fax Modem (2400 bps/9600 bps)	\$330
Port Replicator	\$120

Operating Systems and Application Software

DOS 5.0, Stacker V2.0 and 386MAX 6.0	\$135**
OS/2 2.0, Upgrade from DOS	\$ 99
WordPerfect® 5.1 for DOS	\$355
Lotus® 1-2-3® for DOS	\$355
Microsoft® Excel™ 4.0 for Windows	\$335
Lotus Freelance Graphics® for OS/2	\$425

Non-IBM programs are licensed under the manufacturer's, supplier's or publisher's terms and conditions.

**Promotional price. Offer good until 3/31/93. Offer may be modified or withdrawn at any time.

LAN Communications

Token Ring Network 16/4 Adapter for AT Bus	\$535
EtherCard PLUS Elite 16 Combo™	\$195
PC LAN Program 1.3	\$185
NetWare® V3.11 (5 User)	\$720
IBM OS/2 LAN Server 3.0, Entry	\$505

Printer and Printer Options

IBM Personal Printer Series II, 2390	\$385
IBM ExecJet® Printer, 4072	\$775
500-Sheet Second Drawer for 4019(E), 4029	\$295
PostScript® Option for 4019(E), 4029	\$335

Technical support for IBM printers is provided by Lexmark™ International, Inc.

PS/ValuePoint Displays

IBM 6312 Color Display	\$405
IBM 6314 Color Display	\$530
IBM 6319 Color Display	\$660



Expansion Unit (Docking Station)

The 3550 Expansion Unit for ThinkPad 700 and 700C gives you two slots and one bay, and accommodates 5.25-inch or 3.5-inch SCSI devices.

\$859*

IBM, OS/2, PS/2 and ExecJet are registered trademarks of International Business Machines Corporation. PS/ValuePoint, SLC, ThinkPad, TrackPoint II and HelpWare are trademarks of International Business Machines Corporation.

The Intel Inside Logo, i486 and i487 are trademarks of Intel Corporation. Lexmark is a trademark of Lexmark International, Inc. Windows and Excel are trademarks of Microsoft Corporation. EtherCard PLUS Elite 16 Combo is a trademark of Standard Microsystems Corporation.

Novell and NetWare are registered trademarks of the Novell Corporation. PRODIGY is a registered service mark and trademark of Prodigy Services Company. WordPerfect is a registered trademark of WordPerfect Corporation. Lotus, 1-2-3 and Freelance Graphics are registered trademarks of Lotus Development Corporation. Microsoft is a registered trademark of Microsoft Corporation. PostScript is a registered trademark of Adobe Systems Incorporated.

©1993 IBM Corp.

When calling, please reference X213BYTE.

IBM Direct

CALL TO ORDER TODAY
1 800 IBM 2YOU

1 800 426-2968 8am-9pm EST Monday-Friday

Circle 191 on Inquiry Card.

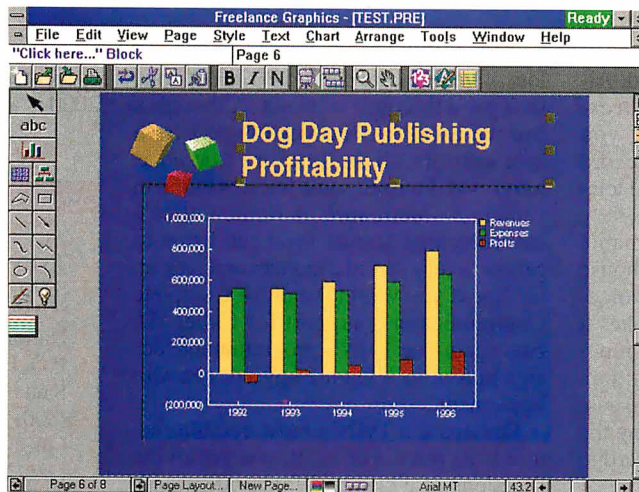


which businesspeople typically use for several hours a day. People use presentation packages only when they need to make a presentation, so the learning curve must be easier and the benefits more immediate. Lotus has taken a step in the right direction with Freelance Graphics for Windows 2.0.

While version 2.0 offers megabytes of advanced features, the beta software I tested was inviting and even fun to use. More important, I produced a presentation in about an hour. After I added some more complex charts and played around with transitions, the entire process took only about 3 hours—not bad for someone whose presentation package up until now has been QuarkXPress.

A tutorial called QuickStart walks you through the process of creating a presentation. While some concepts may seem elementary to presentation pros, beginners will appreciate the effort.

To help you get up and running quickly, version 2.0 provides 65 SmartMaster designs (12 more than the previous version), ranging from simple and elegant to bright and boisterous. The templates have been optimized for black-and-white presentations. According to Lotus, while many users create in color, their handouts or overhead transparencies generally appear in black and white. Two small icons at the bottom of the screen let you easily toggle between color and black-and-white views.



The slide show, or SmartShow in Freelance Graphics parlance, has been improved to let you jump to other pages in the presentation, launch other applications, and play sounds or movies. You can select from 32 transitional effects—rain, paintbrush, and more—as you move from page to page. You also can draw on the page while it's displayed—somewhat like John Madden doing his chalkboard analysis during NFL broadcasts.

Importing spreadsheets into Freelance Graphics for Windows 2.0 is a snap. You can import Lotus 1-2-3 and Symphony worksheets and Excel, dBase, and SYLK files. If you're like me, though, you may find it easier to simply create charts from scratch rather than importing them from spreadsheets. Either approach is painless.

To help you stay focused during presentations, you can add speaker notes to each slide. A small icon in the shape of an index card reminds you which screens

you've annotated. A collapsible outline makes it easy to create or modify a presentation. You can also print your outline.

What would a product be today without multimedia support? Freelance Graphics for Windows 2.0 lets you spruce up your presentations with sound and video.

After using version 2.0 for a week, I feel as if I have only scratched its surface. That's the beauty of it: Its features don't get in the way of preparing a presentation.

—Dan Muse

THE FACTS

Freelance Graphics for Windows 2.0

\$495; upgrade from previous version, \$150

System requirements:

A 286 or higher with Microsoft Windows 3.x running under DOS 3.1 or higher, EGA or better, a mouse, and a minimum of 3 MB of RAM (5 MB is recommended).

Lotus Development Corp.
55 Cambridge Pkwy.
Cambridge, MA 01242
(617) 577-8500
fax: (617) 693-1197

Circle 1172 on Inquiry Card.

A National Voice for the PC

With its first end-user product, National Semiconductor pulls no punches. The **TyIN 2000** packs a 2400-bps data modem, a 9600-bps fax, voice mail, and business audio onto a single PC adapter card. A set of Windows applications delivers these diverse functions to your desktop.

The voice-mail manager handles all your phone messages. When you open a mailbox from the menu or by double-clicking on a mailbox icon, a log of messages is displayed in a dedicated window. You can play back your messages, record a greeting, or send a memo to another mailbox. If

you assign a password to the mailbox, an unauthorized person cannot open the window. The TyIN supports multiple levels of mailboxes, letting you set up an access menu. You can retrieve your messages from a remote phone, and the toll-saver feature issues an extra ring when there are no new messages so you can avoid long-distance charges.

A separate log tracks faxes. Double-clicking on an entry loads the fax image into a viewer. You can send faxes directly from the fax manager or from any other Windows application through a special printer driver. Faxing a file is then as sim-

ple as printing it. The card supports ECM (Error Correction Mode), a standard protocol on many dedicated fax machines that helps ensure high-quality output at the receiving end, and DFT (Document File Transfer), to enable the transmission of electronic files to other DFT-compliant fax boards. The TyIN automatically switches modes for reception of data, voice, or faxes on the same line.

Unlike other products in this category, the TyIN 2000 can also record and play back Windows audio (.WAV) files. You can append spoken comments to a document or spreadsheet that other users (with

audio-capable systems) can listen to. Although the board provides jacks for an external speaker and a microphone, you really do not need either. You can record and play back audio notes through the telephone headset.

Thanks to the TyIN's programmable DSP (digital signal processor), in-house developers can build customized voice-mail applications. The DSP also makes it much easier to upgrade the board's functionality by delivering voice recognition, color fax support, or other upgrades to customers on a software disk, eliminating the need to exchange chips or ship the card to the developer.

I used the TyIN as my personal voice-mail system just prior to Comdex, when

lots of vendors are calling BYTE editors, so it got a thorough workout. Although it had the usual rough edges I expect from beta software, all the functions worked as advertised. I missed some features found in similar products, such as Home Office's call-screening feature (you can listen to callers as they record messages and pick up the line if you want to) and the Complete Communicator's support for Caller ID. But, again, the TyIN's programmable design makes such feature upgrades easy to implement.

Perhaps the TyIN's most notable feature is its price. For \$279, you get all the functions of a standard fax modem with voice mail and business audio to boot. For a business not large enough to support a

dedicated voice-mail system, the TyIN 2000 is an excellent value.

—Stanford Diehl

THE FACTS

TyIN 2000
\$279

National Semiconductor
P.O. Box 58090
Santa Clara, CA 95052
(800) 538-8510
(408) 721-5020
fax: (408) 721-7662

Circle 1173 on Inquiry Card.

WordPerfect Spruces Up Windows

WordPerfect is the leader of the pack in the DOS-based PC word processing software wars, but the Windows market is another story. WordPerfect doesn't dominate, but it's attempting to fight its way to the top with **WordPerfect 5.2 for Windows**. This product is an impressive upgrade to version 5.1.

In addition to adding a host of enhancements to the program, WordPerfect is also bundling Adobe Type Manager and Reference Software International's Grammatik 5 grammar checker. Among the version 5.2 enhancements are full OLE support, mail-enabling to support E-mail programs under the VIM and MAPI mail standards, new macros, import/export for Microsoft Word for Windows 2.0 and Lotus's Ami Pro 2.0, and the text indexing/retrieval feature called QuickFinder, which lets you quickly search file contents by keywords.

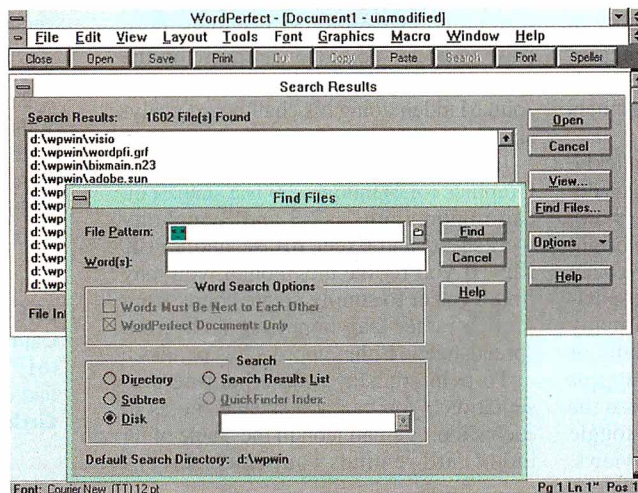
Take WordPerfect's stated memory requirement of 4 MB seriously. The beta version of WordPerfect 5.2 for Windows ran painfully slowly when working with only 2 MB of memory. However, after treating my Compaq Deskpro 386/20e to a long-awaited 4-MB memory upgrade, the updated version of WordPerfect took off. Running under 6 MB of RAM, WordPerfect 5.2 appeared nearly as fast as Mi-

crosoft Word for Windows 2.0, arguably its most formidable competitor.

One of the more intriguing aspects of version 5.2 is QuickFinder, for which WordPerfect is seeking a patent. With QuickFinder, which can be accessed easily from within the word processor itself, you can select certain files for indexing and then create an index that you can later search by filenames, keywords, phrases, or even Boolean operators. The indexes created by QuickFinder are relatively small. For example, indexing an entire 52-MB hard drive results in an index of about 1.6 MB in size. According to WordPerfect, QuickFinder builds index files equal to about 5 percent of the size of the selected files.

WordPerfect, which claims 1.5 million copies sold of version 5.1 for Windows, has thrown more than a few new bells and whistles into version 5.2. Users who purchased the DOS version of WordPerfect after April 1991 receive full licenses to the program under DOS, Windows, and OS/2. According to Devin Durrant, director of WordPerfect for Windows marketing, OS/2 is gaining momentum. And WordPerfect hopes to be the word processor of choice on that platform as well. ■

—Patrick Waurzyniak



THE FACTS

WordPerfect 5.2 for Windows
\$495

System requirements:
A 20-MHz 386 or higher with a minimum of 4 MB of memory.

WordPerfect Corp.
1555 North Technology Way
Orem, UT 84057
(801) 225-5000
fax: (801) 228-5077

Circle 1174 on Inquiry Card.

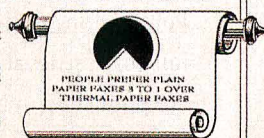
Only one printer can give you this fax.



Our goal at NEC is the complete integration of computers and communications. The Silentwriter Model 95fx is just one of many innovative products that help us to realize this goal. For example, we not only developed the first notebook computer with a built-in phone and fax, we make satellite dishes capable of sending data worldwide.



Once upon a time, all faxes looked the same. *Bad.* But with the Silentwriter® Model 95fx multifunction printer/fax, nothing gets lost in the transmission. Imagine PostScript™ language-quality faxes from your printer. It's no fairy tale. Now you can send and receive documents in all their original glory. You'll see beautiful fonts and graphics with none of the dirt and glitches, the jaggies and imperfections, that can turn a wonderful story into a tragedy. Why send a facsimile when you can send an original? Get the NEC Silentwriter Model 95fx multifunction printer/fax and live happily ever after.



The End


Actual facsimile generated from a Silentwriter Model 95fx.

And these facts.

- 1 A state-of-the-art 6 PPM laser printer equipped with Adobe's PostScript™ Level 2 and HP's PCL5.
- 2 Send and receive faxes in either conventional or PostScript-language formats.
- 3 Patented Sharp Edge Technology delivers 600 DPI-equivalent clarity.
- 4 Automatic interface switching supports both Macs and PCs.
- 5 Under \$2,349 (MSRP). Far less than you'd pay for any printer/fax multifunction combination.



The Silentwriter Model 95fx Printer/Fax

Because  is the way you want to go. **NEC**



November 24, 1992
NEC Silentwriter Model 95



POSTSCRIPT
Software from Adobe



"...all the PostScript printer you'll ever need."
PC/Computing
"The Ideal Windows PC."
June 1992

To upgrade your existing Silentwriter Model 95 printer with fax capability (U.S. only), or for more information about the Silentwriter Model 95fx, call NEC at 1-800-325-5500.

Circle 107 on Inquiry Card.

WE'RE ONLINE. AND IN LINE WITH YOUR OBJECTIVES.

BUSINESS WEEK

AEROSPACE DAILY

AEROSPACE PROPULSION

AIRPORTS

AVIATION DAILY

AVIATION EUROPE

AVIATION WEEK &
SPACE TECHNOLOGY

BIOTECHNOLOGY NEWSWATCH

BYTE

CHEMICAL ENGINEERING

CLEAN-COAL/SYNFUELS LETTER

COAL WEEK

DATA COMMUNICATIONS

ELECTRICAL WORLD

ELECTRIC UTILITY WEEK

ENGINEERING NEWS-RECORD

FEDERAL TECHNOLOGY REPORT

HAZARDOUS WASTE BUSINESS

INDEPENDENT POWER REPORT

INDUSTRIAL ENERGY BULLETIN

INSIDE ENERGY/
WITH FEDERAL LANDS

INSIDE F.E.R.C.

INSIDE N.R.C.

INTEGRATED WASTE MANAGEMENT

LAN TIMES

MODERN PLASTICS

NUCLEONICS WEEK

POSTGRADUATE MEDICINE

THE PHYSICIAN & SPORTSMEDICINE

PLATT'S INTERNATIONAL
PETROCHEMICAL REPORT

PLATT'S OILGRAM NEWS

PLATT'S OILGRAM PRICE REPORT

POWER

S&P'S EMERGING & SPECIAL
SITUATIONS

S&P'S REVIEW OF BANKING
& FINANCIAL SERVICES

S&P'S REVIEW OF SECURITIES
& COMMODITIES REGULATION

SECURITIES WEEK

UTILITY ENVIRONMENT REPORT

THE WEEKLY OF BUSINESS AVIATION

UNIXWORLD

AND MORE...

When you need business information, why not get the total story, instantly! Word for word. The McGraw-Hill Publications Online database gives you just that. Unedited, full-text retrieval (except graphics) of articles exactly as they are published in McGraw-Hill magazines and newsletters.

Now you can get information on companies, people and products on any topic—pertaining to one particular industry, or search the entire McGraw-Hill library (over 40 leading publications online) for diverse editorial perspectives. Only McGraw-Hill, the world's foremost business information publisher, can deliver it all so completely—immediately! McGraw-Hill unabridged.

Access an entire universe of business information. Go online with our line. McGraw-Hill Publications Online. For more information, including our latest list of publications, contact Andrea Broadbent at (609) 426-5523. Or fax this coupon to (609) 426-7352.

Or send it to the address below.

Available through Dialog®, Dow Jones News/Retrieval®, NewsNet®, Nexis® and FT Profile (U.K.)

McGRAW-HILL PUBLICATIONS ONLINE

Princeton-Hightstown Road
Hightstown, NJ 08520 U.S.A.



Please send me the complete list of your publications online.

BY

Name _____

Title _____

Company _____

Address _____

City _____

State _____

Zip/Postal Code _____

Country _____

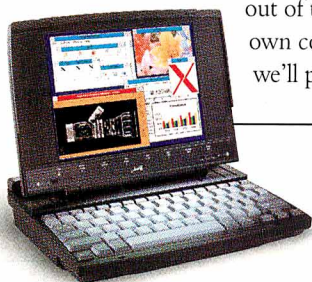
Tel. _____

GO ONLINE WITH OUR LINE.

Now you can run X from virtually any hole in the wall.



There's really only one way to effectively run X from a phone jack—NCD's PC-Xremote Edition of PC-Xview. It's a special version of our X server software for PCs, one that doesn't require LAN support. Just install it on your laptop or home personal computer and you can run X out in the country, out of the country, or better still, in the comfort of your own home. For your very own copy or more information, call NCD at 1-800-793-7638. For just \$199, we'll place the power of X right on your desktop. Wherever that may be.



Network Computing Devices, Inc. **NCD**

Circle 206 on Inquiry Card.

CAD Power

The Tri-CAD DX2-VL graphics workstations, based on the 50- and 66-MHz DX2 processors, are VESA VL-Bus-compliant and include graphics accelerators with ATI's Mach-32 chips and 2 MB of VRAM (video RAM). This combination provides RISC-level performance with PC flexibility and ease of use, according to Tri-Star. The systems have 8 MB of RAM and 256 KB of secondary cache memory.

With a 32-bit VL-Bus Mastering SCSI-2 host that supports SCSI-2 hard drives of from 210 MB to 1.7 GB, the machines support up to seven SCSI devices. Other features include clock-doubling technology and 32-bit local-bus IDE hard drive controllers. A 17-inch Hitachi flat square color display is standard.

Price: Begins at \$3595.

Contact: Tri-Star Computer Corp., Chandler, AZ, (602) 961-3401; fax (602) 961-4010.

Circle 1131 on Inquiry Card.

Power Notebook

With a 500-MB hard drive, Identity Systems' 386SXL-25 notebook computer is well equipped for receiving faxes and hosting large applications. The 7-pound portable has a backlit VGA gray-scale display, 4 MB of RAM, an internal floppy drive, two serial ports, one parallel port, DOS 5.0, Windows 3.1, and Works. Modems and alternate memory configurations are optional.

Price: \$2995.

Contact: Identity Systems Technology, Inc., Richardson, TX, (214) 235-3330; fax (214) 907-9227.

Circle 1132 on Inquiry Card.



The Tri-CAD DX2-VL's graphics adapter provides noninterlaced resolutions of up to 1280 by 1024 pixels with 256 colors.

Portable Color

EuroPak's Eurocom 5500DX2C Super-Notebook has more power than many desktop systems. Packed into the 50-MHz 486DX2's 5.5-pound frame are a 120-MB hard drive, a floppy drive, 4 MB of RAM (expandable to 8 MB), and a passive-matrix triple-supertwist 9-inch LCD, capable of displaying 256 colors at 480-by-640-pixel resolution. Standard interfaces include two serial ports, a parallel port, and ports for an external VGA monitor, a keyboard, and more.

To save energy, the notebook has sleep and smart-sleep modes. The detachable battery pack provides power for up to 2½ hours. The docking station option includes two 16-bit slots, a keyboard port, two serial ports, and one parallel port.

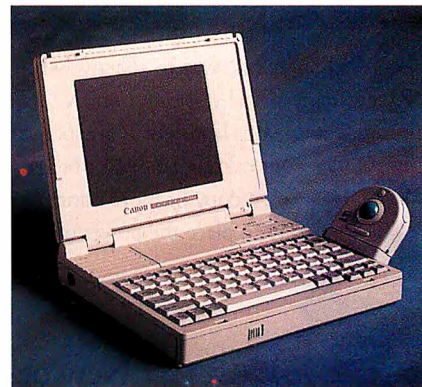
Price: \$3450; docking station, \$300.

Contact: EuroPak International, Nepean, Ontario, Canada, (613) 721-3221; fax (613) 722-2767.

Circle 1133 on Inquiry Card.

Talk to Your Notebook

The custom-designed Wen 486 SuperNote-Voice color notebook includes a telemarketing-style headset with a microphone that lets you send verbal instructions to the unit. Wen's proprietary voice-recognition software features as many as 1000 isolated words or phrases with better than 98 percent accuracy. Also included are concurrent operation of voice recognition and unlimited text-to-speech synthetic voice output.



The notebook's basic configuration has 2 MB of RAM (expandable to 10 MB), 128 KB of ROM, and 8 KB of cache memory. It also includes a 60-MB hard drive and a 387 coprocessor socket.

Price: \$4500 and up.

Contact: Wen Technology Corp., Elmsford, NY, (914) 347-4100; fax (914) 347-4128.

Circle 1134 on Inquiry Card.

First Computers

Canon's entry into the computer market brings with it two 25-MHz 486SX machines. The Innova 486 desktop is upgradable to all 486-based microprocessors, including the 66-MHz DX2. The system has a color Super VGA monitor, 4 MB of RAM, 8 KB of internal and 64 KB of external cache memory, a 130-MB hard drive, and dual floppy drives.

The 5.8-pound Innova 486NX color notebook is upgradable to a 50-MHz 486DX2 unit. It has 4 MB of RAM (expandable to 12 MB on-board), 8 KB of internal cache memory, a 120-MB hard drive, and a 1.44-MB floppy drive. The just-over-9-inch screen is a passive-matrix color VGA LCD with 16 colors. Interfaces include a PCMCIA expansion port and a PS/2 mouse port. A Logitech TrackMan mouse and a nickel-metal-hydride battery are standard.

Price: Innova 486, \$1899; Innova 486NX, \$3999.

Contact: Canon Computer Systems, Inc., Costa Mesa, CA, (800) 848-4123 or (714) 438-3000; fax (714) 438-3099.

Circle 1135 on Inquiry Card.

Canon's Innova 486NX.

CD-ROM Made Easy

Available in a slim portable case or as a cube, the Venturer CD-ROM drive conforms to the ISO 9660/High Sierra standard and is compatible with CD-ROM modes 1 and 2. A top-loading mechanism frees the front of the unit for a hi-fi audio CD-player control panel that lets you play music without PC software.

The Venturer features a proprietary interface or an optional parallel port interface for notebook compatibility. With the MS-DOS CD extension, the unit is multimedia applications-compliant. The data transfer rate is 150 KBps, and the average access time is 800 ms. The drive, which has a 2352-byte buffer, can read standard 12- and 8-cm CDs.

Price: \$179.

Contact: North-East Micro-computer, Ltd., Markham, Ontario, Canada, (416) 513-6800; fax (416) 513-6802.

Circle 1136 on Inquiry Card.

Data in Large Chunks

Capable of up to 12 GB of uncompressed data storage via 12-mm proprietary DAT (digital audiotape) technology, the VDAT SCSI data-storage system provides more than 25 GB of compressed data storage at a 2-to-1 average compression ratio. Sustained data transfer rates for the unit reach 2500 KBps. The PC-compatible VDAT comes with 56-bit and full Reed-Solomon error-correction code.

Price: \$11,995.

Contact: TenTime, a division of Laura Technologies, Inc., Chandler, AZ, (602) 940-9800; fax (602) 940-0222.

Circle 1137 on Inquiry Card.



The Venturer CD-ROM has a 150-Kbps data transfer rate, an 800-ms average access time, and a 2352-byte buffer.

Monitors for Different Uses

The HM-6421 21-inch, 2-megapixel-resolution color monitor has 1600- by 1280-pixel, 28-mm-dot-pitch flat-screen vertical scanning of 72 to 77 Hz. The monitor uses Hitachi's proprietary analog dynamic convergence circuitry for a misconvergence of 25 mm in the center viewing area and 35 mm in the perimeter. The company's patented Elliptical Aperture Dynamic Focus system passes electron beams through an elliptical rather than a round aperture in peripheral areas and then controls the beams for sharp images throughout the screen.

Price: \$5495.

Contact: Hitachi America, Ltd., Office Automation Systems Division, Montvale, NJ, (201) 573-0774; fax (201) 573-7660.

Circle 1138 on Inquiry Card.

The High-Resolution Multi-Sweep circuitry of Image Systems' M21LMUMAX gray-scale monitor lets the monitor dynamically adjust to horizontal frequencies of 15 to 65 kHz or 48 to 105 kHz and a vertical frequency of 55 to 90 Hz. Noninterlaced display mode is available at resolutions of up to 2048 by 1536 pixels, and the video bandwidth is 200 MHz. You can manually adjust the display area to a maximum of 16 by 12 inches on the 21-inch screen. With its Mumetal protective shielding, the monitor can operate next to x-ray equipment without influence from magnetic flux.

Price: \$5950.

Contact: Image Systems Corp., Hopkins, MN, (612) 935-1171; fax (612) 935-1386.

Circle 1139 on Inquiry Card.

A flat square display and temperature-controlled color matching to printed output are two reasons for the

ViewSonic 15's appeal. The display's 1024- by 768-pixel resolution has refresh rates of up to 76 Hz, and the 28-mm dot pitch provides depth and clarity to images. Invar shadow-masked technology makes the images bright and crisp. The monitor automatically adjusts to horizontal scan frequencies of 30 to 64 kHz. You can store up to 26 programmable settings in memory on the monitor, which is IBM- and Mac-compatible.

Price: \$849.

Contact: ViewSonic, Walnut, CA, (800) 888-8583 or (909) 869-7976; fax (909) 869-7958.

Circle 1140 on Inquiry Card.

Port Sound to Your System

A plug-and-play external sound system, Digi-speech Port-Able Sound adds CD-quality audio to your PC. The system automatically loads its software drivers when you initially plug it into your computer's parallel port. With a pass-through that lets your printer continue functioning, Port-Able Sound senses whether files going through the port are intended for the printer or for itself.

System features include a built-in speaker and microphone, an on/off switch with an LED that indicates when the sound is turned off, input jacks for a CD player, output jacks for external speakers, audio stereo sound, and Lotus Sound software. The system is compatible with Windows 3.1, Windows Multimedia Extensions, SoundBlaster Pro, and Pro Audio Spectrum.

Price: \$189.95.

Contact: Digispeech, Inc., Placerville, CA, (916) 621-1787; fax (916) 621-2093.

Circle 1141 on Inquiry Card.

Speed and Color on Plain Paper

Able to print 2 ppm, the Phaser 200i and Phaser 200e 300-dpi printers print on transparencies and common office paper. The printers use Tektronix's new P2T2 technology, which incorporates proprietary image-processing techniques and a custom transfer ribbon to apply a transparent primer coat on the paper only where needed. The printers also use Tektronix's proprietary TekColor color management and image-rendering technologies and offer the TekColor Display Adjust and Blue Adjust options.

The Phaser 200 Series printers include parallel, serial, and AppleTalk ports with automatic switching among them. The company's 4511A network interface provides TCP/IP and DECnet connectivity, and an optional EtherTalk interface is available for the Phaser 200i. The Phaser 200i comes with 6 MB of expandable memory; the Phaser 200e has 4 MB. In addition to PostScript Level 2 page description software, the printers support HPGL (Hewlett-Packard Graphics Language).

Price: Phaser 200e, \$3695; Phaser 200i, \$5995.

Contact: Tektronix, Inc., Wilsonville, OR, (800) 835-6100 or (503) 682-7377.

Circle 1142 on Inquiry Card.

Network Color Printing

The Codonics NP-600 color network printer uses dye-sublimation technology to produce photographic-quality images. Designed to work with any homogeneous or heterogeneous



The Tektronix Phaser 200 Series workgroup printers, sized to fit on your desk, run in unattended mode.

TCP/IP network, the printer connects to existing Ethernet or token-ring networks. It uses the industry-standard TCP/IP protocol to print files originating from DOS, Unix, and DEC VMS systems. Host computers do not require any special software drivers.

The printer automatically identifies the transmitted image's file format by recognizing header information embedded in every file, so you don't need to specify the file format types. Image file formats that the Codonics NP-600 recognizes include TIFF, GIF, PCX, Macintosh PICT, Sun raster, Portable Pixmap, and X11 Bitmap. With 16.7 million simultaneously printable colors, the printer can produce continuous-tone format prints.

Price: \$12,500.

Contact: Codonics, Inc., Middleburg Heights, OH, (800) 444-1198 or (216) 243-1198; fax (216) 243-1334.

Circle 1271 on Inquiry Card.

The Codonics NP-600.



Rugged Forms Printer

A high-speed, high-precision, dual-head impact printer designed for prolonged printing of multiple forms and heavy card stock, the TXP-800 form printer feeds, prints, and sequentially stacks forms, tickets, or cards. The nine-pin dot-matrix printer achieves burst speeds of up to 415 cps for 231 lpm.

The TXP-800's bit-mapped graphics capability lets you print at densities of 60, 120, and 240 dpi. You can also print bar code graphics of dot-matrix quality at high-density settings and set character spacing at 10, 12, or 17 per inch. The printer includes IBM Proprinter emulation with simplified programming instructions.

Price: \$1925.

Contact: CTSI International, Inc., Ronkonkoma, NY, (516) 467-1281; fax (516) 467-2033.

Circle 1143 on Inquiry Card.

Print Graphics on This One

Brother's HL-10PS 300-dpi laser printer incorporates the company's BR-Script PostScript language

interpreter, which also provides full support for Adobe Type 1 and Multiple Master fonts. In addition, the HL-10PS emulates the HP LaserJet III.

Standard features on the 10-ppm printer include automatic interface and emulation switching, 37 resident fonts, high-resolution control, and data compression. Standard interfaces include Centronics parallel, AppleTalk/RS-422A serial, and RS-232 serial ports. The HL-10PS supports unlimited gray shades in BR-Script mode and 64 shades in PCL (Printer Control Language) mode. The display and control panel tilts upward for ease of operation and readability; printer messages can be set in six languages.

Price: \$2395.

Contact: Brother International Corp., Office Systems Division, Somerset, NJ, (908) 356-8880; fax (908) 356-4085.

Circle 1144 on Inquiry Card.

Print in Pantone Colors

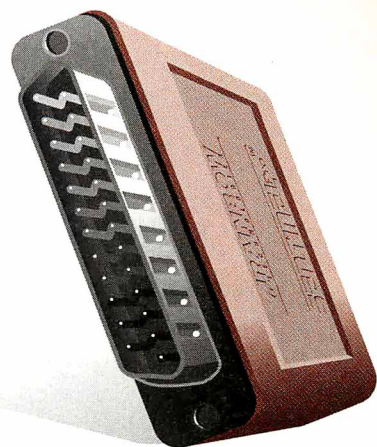
The SpectraStar Q10 color thermal wax-transfer printer features Pantone-certified color matching and a three-color ribbon. The PostScript Level 2-compatible printer has 6 MB of RAM (expandable to 10 MB) for print spooling—letting the unit store copies of a document in memory—and a 20-MHz RISC processor. The printer supports PCs, Macs, and shared environments.

Price: About \$6634 (£4350).

Contact: Reflex, Ltd., Reading, Berkshire, U.K., +44 734 313611; fax +44 734 314439.

Circle 1145 on Inquiry Card.

Why do they call it a dongle?



He wasn't famous. He didn't drive a fancy car, but dressed in his favorite Comdex T-shirt and faded blue jeans, he set out to change the course of the computer software industry. Quite a task for a lonely software developer.

Sitting in front of his computer, drinking pots of coffee and smoking cartons of cigarettes, he'd write pages of code.

It took time. Years in fact. But he did it. He wrote the most powerful computer program in the world. Now came the hard part. Selling it.

The Most Powerful Program in the World

Determined to make those long years pay off, he called on every distributor, VAR and dealer in the world. He drove from Beantown to San Diego. Flew from Dublin to Borneo. Everyone loved the program.

So he sold a few. Only a few.

Back in Boston he waited. After a long year

with only 13 orders he set out to see what happened. As he drove across the



country and flew around the world he

discovered everyone knew about his program. Everyone had it too.

The Global Marketplace

From Paris to Prague, his program was everywhere in Europe. When he got off the plane in Hong Kong he found his program stacked to the ceiling in every computer store. Amazed in disbelief, he bought a hundred cartons of cigarettes and a hundred pounds of Indonesian coffee and flew back to Boston.

Beaten, battered and bruised he went back to the drawing board. This time he would really change the face of the software industry. He would develop a device that would prevent unauthorized distribution of software programs.

Call It What You Like

He developed a hardware key. His peers applauded his efforts. Finally, a solid solution for revenue protection.

But he didn't know what to call it. He thought of naming it after an exotic place he visited in his travels. Madagascar was a bit too long, though.

"Name it after you, Don!", urged his peers. So he did. Soon everyone was calling the key a dongle, after Don Gall — the lonely software developer who did what he had to do.

You've Come A Long Way, Baby

Today, dongles are different. Fact is, they've come a long way.

Leading the industry with security solutions, Rainbow Technologies has changed the face of hardware keys. They work with multiple applications, are programmable and network versions control concurrent usage. And they're always transparent to the end-user.

Sentinel Family from Rainbow

Truth is, more and more developers are using keys. And the Sentinel Family is the most widely used in the world. In fact, over 6,000

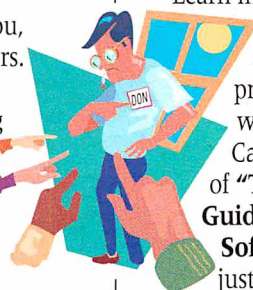
developers use Sentinel from Rainbow. Why? They are simply the most effective, reliable and easy to implement keys on the market.

Learn more about securing

your software and how keys provide developers with extra value. Call for a free copy of "The Sentinel Guide to Securing Software." And see just how easy it is to

install a hardware key into your application in just minutes. Try it with our low cost Sentinel Evaluation Kit. Order one for your DOS, OS/2, Windows, Macintosh or UNIX based application.

And remember, when you need a dongle, you need Sentinel — the only dongle Don Gall would use.



CALL
800/ 852-8569

FOR YOUR FREE GUIDE
TO SECURING SOFTWARE

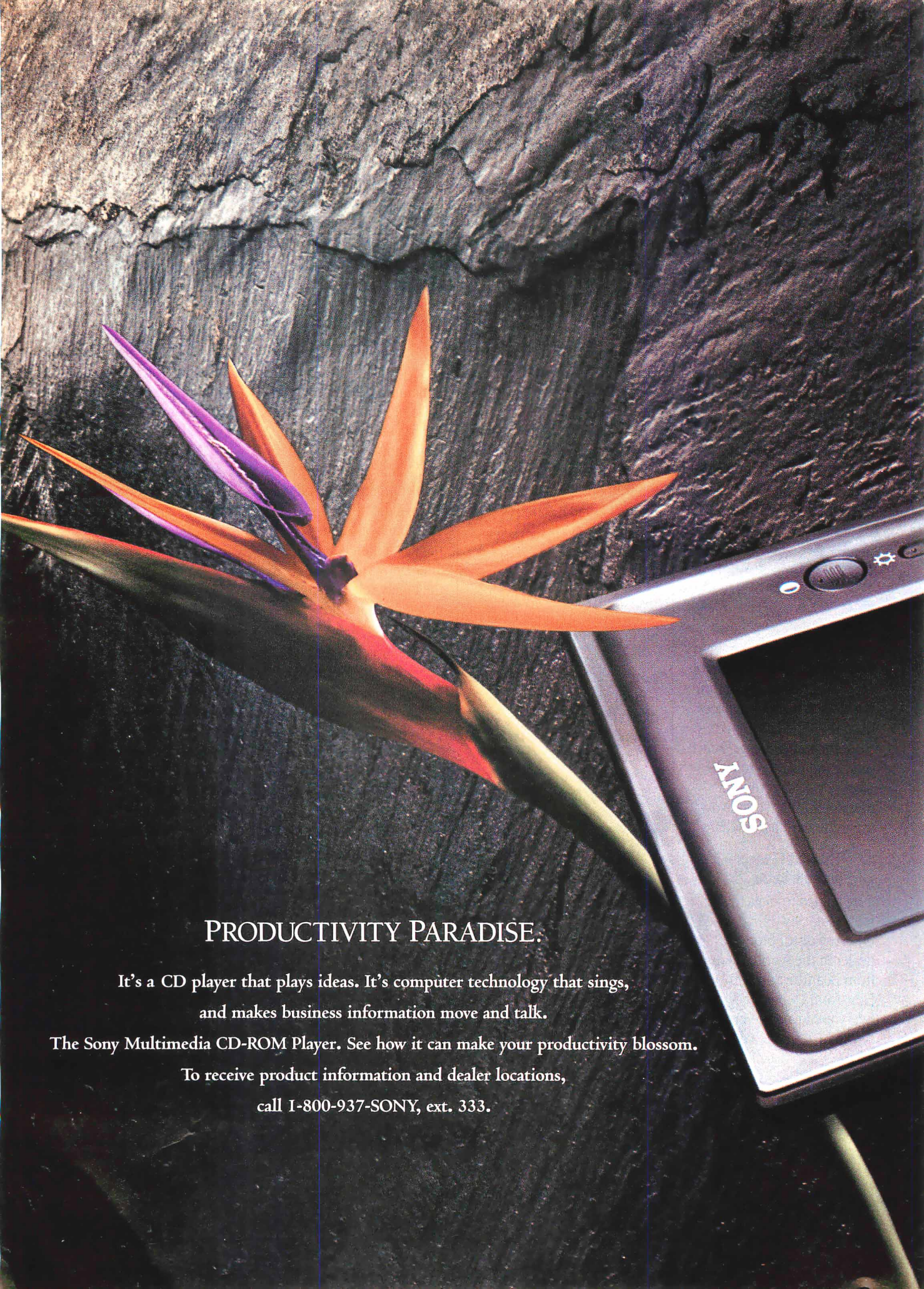
SENTINEL
Securing the future of software

Some call it a dongle. Those who know, call it Sentinel.



9292 JERONIMO ROAD, IRVINE, CALIFORNIA 92718 ■ 714/ 454-2100 ■ fax 714/ 454-8557
International offices are located in the United Kingdom, Germany and France.

Circle 128 on Inquiry Card (RESELLERS: 129).



PRODUCTIVITY PARADISE.

It's a CD player that plays ideas. It's computer technology that sings,
and makes business information move and talk.

The Sony Multimedia CD-ROM Player. See how it can make your productivity blossom.

To receive product information and dealer locations,
call 1-800-937-SONY, ext. 333.

SONY



Full-Motion Video

Windows 3.1-compatible, the VideoSurge 24-bit full-motion video board has audio pass-through and lets you select your video source from NTSC, SECAM, or PAL. Super-VHS is available as an option.

You can scale the video windows to any size, zoom them, and choose to have your scaled image fit or not fit in windows. If you choose the latter, you can do real-time panning and framing to display only a portion of the video. The board supports Super VGA resolutions of up to 1024 by 768 pixels.

As a video capture board, VideoSurge captures images into graphics file formats such as Bitmap, PCX, Targa, and TIFF. You can individually select and control the board's three sets of stereo inputs, each with volume, bass, treble, and balance control.

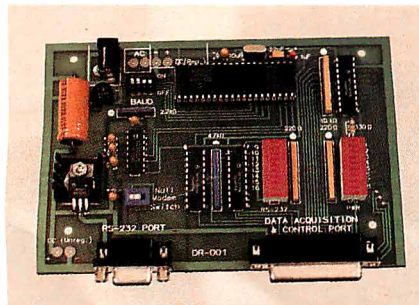
Price: \$995; with S-VHS input, \$1095.

Contact: Aitech International, Milpitas, CA, (800) 882-8184 or (408) 946-3291; fax (408) 946-3597.

Circle 1272 on Inquiry Card.

Digital I/O Control

The Quick Control Board puts data acquisition and control capabilities in your PC or Mac via the RS-232 port. Each of the board's 16



Intelligent Automation's Quick Control Board.

The Aitech VideoSurge is designed to function as a system or as an individual board with specific functionality.

digital I/O lines has its own LED. Four 8-bit A/D converters can digitize signals between 0 and 5 V. At 19,200 bps, individual lines can be set up at 1920 state changes per second and read at 960 samples per second; A/D converters can also be read at 960 samples per second. Other features include a built-in null-modem switch, and two auxiliary 5-VDC power outputs drive external devices.

Price: \$220.

Contact: Intelligent Automation, Inc., Rockville, MD, (301) 990-2407; fax (301) 990-2409.

Circle 1274 on Inquiry Card.

Resolution Boost

Get 600- by 600-dpi resolution and automatic network capability on your Hewlett-Packard LaserJet II Series printer with the ImageUp board. The board installs in the base of the printer to replace the printer's controller board.

Based on a Weitek XL-8220 25-MHz processor, ImageUp includes AppleTalk, parallel, and serial interfaces. NewGen's Automatic Recognition Technology automatically switches between protocols for shared-resource printing and handles switching among PostScript, PCL 4, and HPGL files without driver modifications.

Price: \$1495.

Contact: NewGen Systems Corp., Fountain Valley, CA, (714) 641-8600; fax (714) 641-2800.

Circle 1273 on Inquiry Card.

DSP-Based Multimedia

An accelerator board that's a DSP (digital signal processor)-based multimedia application development platform, the QuantumDSP board is based on AT&T's 27.5-MFLOPS DSP3210. With VCOS (Visible Caching Operating System) and VMDE (VCOS Multimedia Development Environment), the board lets designers implement PC-based functions such as data and fax modems, audio and image compression, and CD-quality stereo. The DSP and the host PC can access the 2 MB of 70-second DRAM on the ISA-compatible board.

Price: QuantumDSP, \$595; VMDE, \$3000; DSP3210 design tools, \$2000.

Contact: Communication Automation & Control, Inc., Allentown, PA, (800) 367-6735 or (215) 776-6669; fax (215) 770-1232.

Circle 1275 on Inquiry Card.

Put Your Graphics on TV

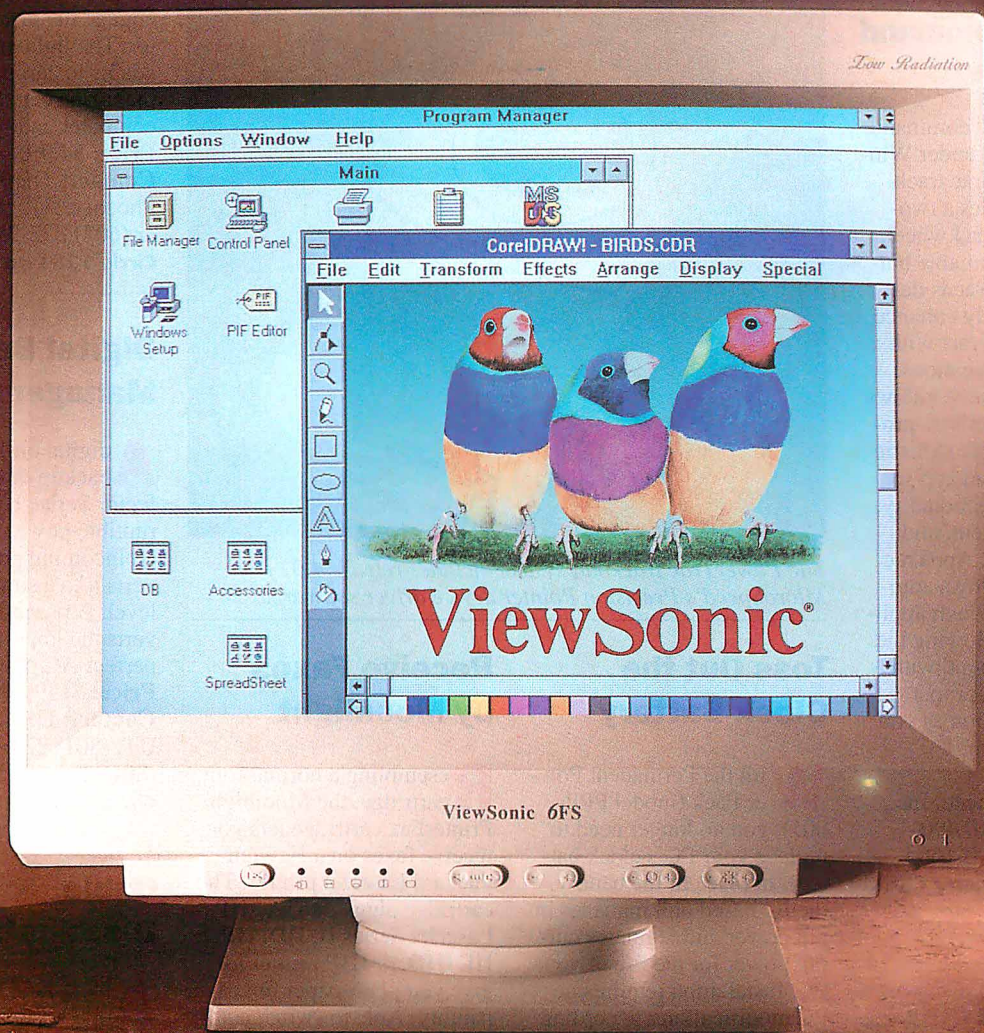
VGA2TV Pro displays computer graphics on a TV screen or VCR in up to 256 colors. The board supports NTSC or PAL; it overlays PC graphics on an input video source such as a VCR and outputs them onto videotape or TV. Compatible with any VGA board with a standard feature connector, the board features a full-frame buffer and supports text and graphics at up to 640- by 480-pixel resolution.

Price: \$895.

Contact: Genoa Systems Corp., San Jose, CA, (800) 934-3662 or (408) 432-0909; fax (408) 434-0997.

Circle 1276 on Inquiry Card.

Expand Your View



Yes, it's definitely time you expanded your view to the non-interlaced 15" ViewSonic 6FS monitor.

For one thing, you get 36-percent more viewing space than with a standard 14" monitor. And, since you can display more information on the screen with the larger 15" flat square screen, this is an ideal monitor for Windows, Graphical User Interface (GUI) and desktop publishing environments.

Thanks to the ultra high 72Hz refresh rate with resolution up to 1,024 x 768, the ViewSonic 6FS produces the most vivid and precise **flicker-free** image anywhere. In addition, the non-glare screen reduces irritating reflections.

The monitor, compatible with all standard resolutions, features 32 programmable modes with digital controls to store and customize

the display to fit your specific needs. It also is certified to meet strict MPR-II Swedish certifications for low emissions, which makes it environmentally safe. It's a fact—the ViewSonic 6FS offers special features normally available only on larger, more expensive monitors.

Expand your view, not your budget, with the affordable 15" ViewSonic 6FS monitor.

ViewSonic®

20480 E. Business Parkway
Walnut, CA 91789

(714) 869-7976 (800) 888-8583 Fax: (714) 869-7958

For immediate faxed information, call the FaxSonic "hot line" at (714) 869-7318—it's available 24 hours a day.

All products and brand names are registered trademarks of their respective companies.

Circle 146 on Inquiry Card (RESELLERS: 147).

Windows Command and Control

A self-contained command center for use under Windows, the PowerTrac trackball system includes a two-button mouse, a trackwheel, and three programmable buttons. The PowerTrac is designed to intuitively enhance your ability to interact with Windows 3.1 applications.

TRAC.DRV, the Windows 3.1 control panel driver, provides user-definable ballistic gain, tracking speed and sensitivity, button functionality, drag lock assignment, and AutoDrag control. AppTrac software for Windows automatically senses which application is active, allowing the PowerTrac to respond with commands for the proper Windows application as you switch among them.

Price: \$149.

Contact: MicroSpeed, Inc., Fremont, CA, (510) 490-1403; fax (510) 490-1665.

Circle 1277 on Inquiry Card.

The Travel Connection

The Konexx Kit provides all the tools you need to connect your fax modem to any telephone in the world. Once connected, you can communicate at speeds up to 9600 bps. The kit includes the Konexx Koupler Model 203, a Merlin Phone Adapter, and a 9-V battery.

Price: \$169.

Contact: Unlimited Systems Corp., San Diego, CA, (800) 275-6354 or (619) 277-3300; fax (619) 277-3305.

Circle 1278 on Inquiry Card.

The Konexx Kit.



The PowerTrac trackball system includes release 4.0 of MicroSpeed's Precision Pointer device driver software.

Toss Out the Clock Battery

With the Permanent Power Pack (model PPP-001), you no longer need to replace your PC's clock battery. In place of the battery, the IC-based unit manages input power and regulates output power for the life of your PC. Installation requires no PC modifications, according to the company.

Price: \$49.95.

Contact: MicroApps, Sunnyvale, CA, (408) 735-1015.

Circle 1279 on Inquiry Card.



Receive Faxes by Moonlight

Resembling a normal font cartridge, the Moonlight PrinterFax cartridge lets you receive faxes on a Hewlett-Packard LaserJet printer. The cartridge plugs into any HP LaserJet Series II, IID, IIP, III, IIID, or IIIP printer to give you plain-paper fax capability. Able to switch automatically between printer and fax modes, the cartridge provides precise date and time stamping.

Price: \$259.

Contact: Moonlight Computer Products, Inc., San Diego, CA, (619) 625-0300; fax (619) 625-0199.

Circle 1280 on Inquiry Card.

Safe CD-ROM Movement

Now you can safely move your CD-ROM discs between their storage cases and your CD-ROM drive. The Disclift acts as an extension of your hand to let you handle the disc by its outer edges or

engage the disc from its center. The lightweight device adapts to carousel players, magazine cartridges, and CD-computer caddies.

Price: \$4.99.

Contact: The Audio File Co., Phoenix, AZ, (800) 662-0224 or (602) 272-2809.

Circle 1281 on Inquiry Card.

Digital Battery Management

A digital on-line battery backup device, the Perfector Series UPS (uninterruptible power supply) uses all incoming power and converts it to a simple energy level. A processor then converts the imperfect power into perfect AC power.

Price: \$1599.95.

Contact: DSK, Inc., Orem, UT, (801) 224-4828; fax (801) 224-5872.

Circle 1282 on Inquiry Card.

Cable Diagnostician

A hand-held network cable diagnostics and certification tool for coaxial and unshielded twisted-pair cable, the MT350 Scanner is designed for multiple types of networks. You can print the results to a portable printer, download them to the scanner's PC-based CMS (cable management system), or integrate them into any database.

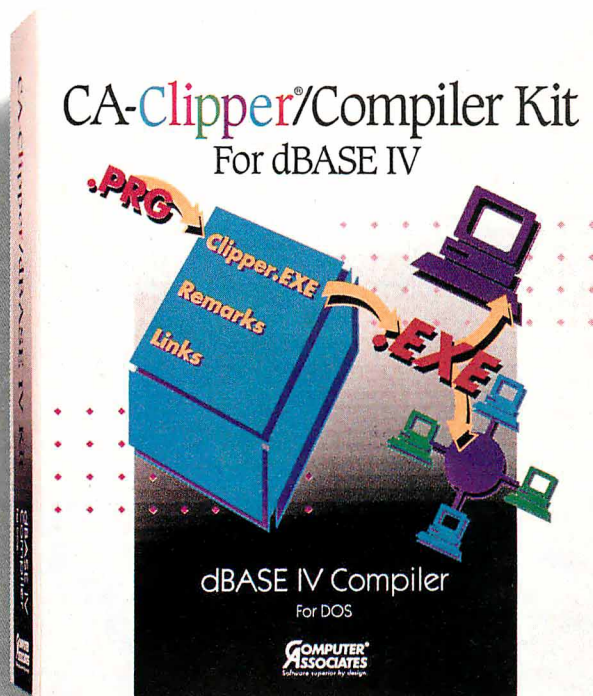
Price: Scanner kit, about \$4575 (£3000); CMS, about \$534 (£350); portable printer option, about \$450 (£295).

Contact: M-Group, London, U.K., +44 81 877 1711; fax +44 81 874 7265.

Circle 1283 on Inquiry Card.

Your dBase IV Compiler Has Arrived.

CA-Clipper®/Compiler Kit For dBASE IV



Finally.

Four years after Ashton-Tate promised it to you, CA is proud to deliver the CA-Clipper/Compiler Kit you've been waiting for.



Readers of Data Based Advisor awarded first place to CA-Clipper 5.01 for Best dBase Compiler, Best Development Language and Best Application Development Product.

Now you can compile most dBASE IV applications in just three easy steps. First, create an application using all the dBASE IV tools you're already familiar with. Next, test and optimize the code to

ensure it performs to specifications. Then use the DPREP program to compile it and produce an executable, .EXE file that gives you all the speed and efficiency CA-Clipper® is famous for.

The CA-Clipper/Compiler Kit For

dBASE IV provides compatibility and database interoperability with most dBASE IV applications. And it's implemented using the open architecture of CA-Clipper, including the pre-

processor, the Extend System and the RDDs.

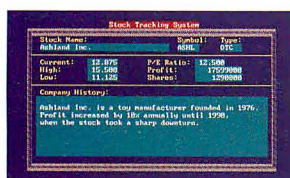
Call 1-800 CALL CAI for the name of your nearest dealer and a free statement of direction entitled "The Future of Xbase". Call right now.

Haven't you waited long enough?

The
Future
of
Xbase
COMPUTER ASSOCIATES



Step 1. Create applications using familiar dBASE IV tools and utilities, or even the dBASE IV Applications Generator.



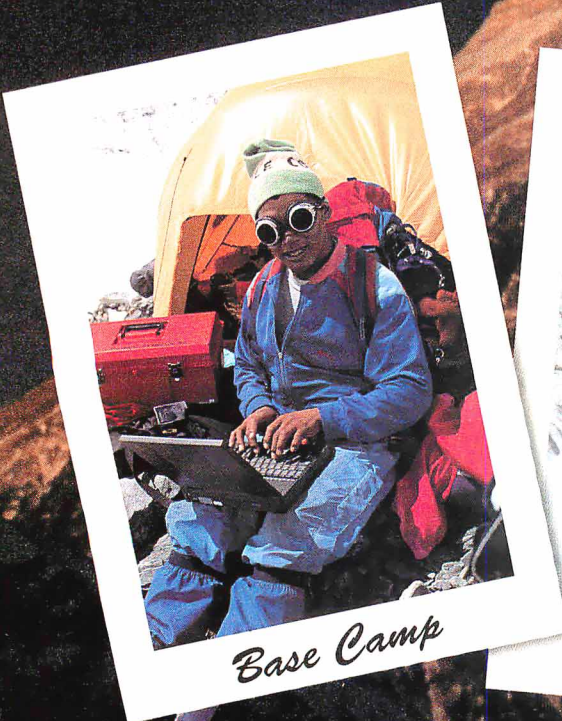
Step 2. Test and optimize code to ensure it performs according to specifications.



Step 3. The COMPILER command invokes the DPREP program. If no errors are detected, the batch file launches compile and link procedures, producing an executable, .EXE file.

© Computer Associates International, Inc., One Computer Associates Plaza, Islandia, NY 11788-7000. 1-800 CALL CAI. dBASE and dBASE IV are registered trademarks of Borland International, Inc. All product names referenced herein are trademarks of their respective companies.

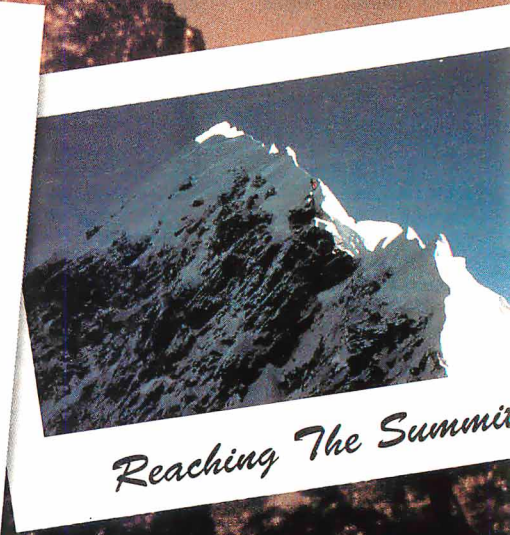
Circle 76 on Inquiry Card.



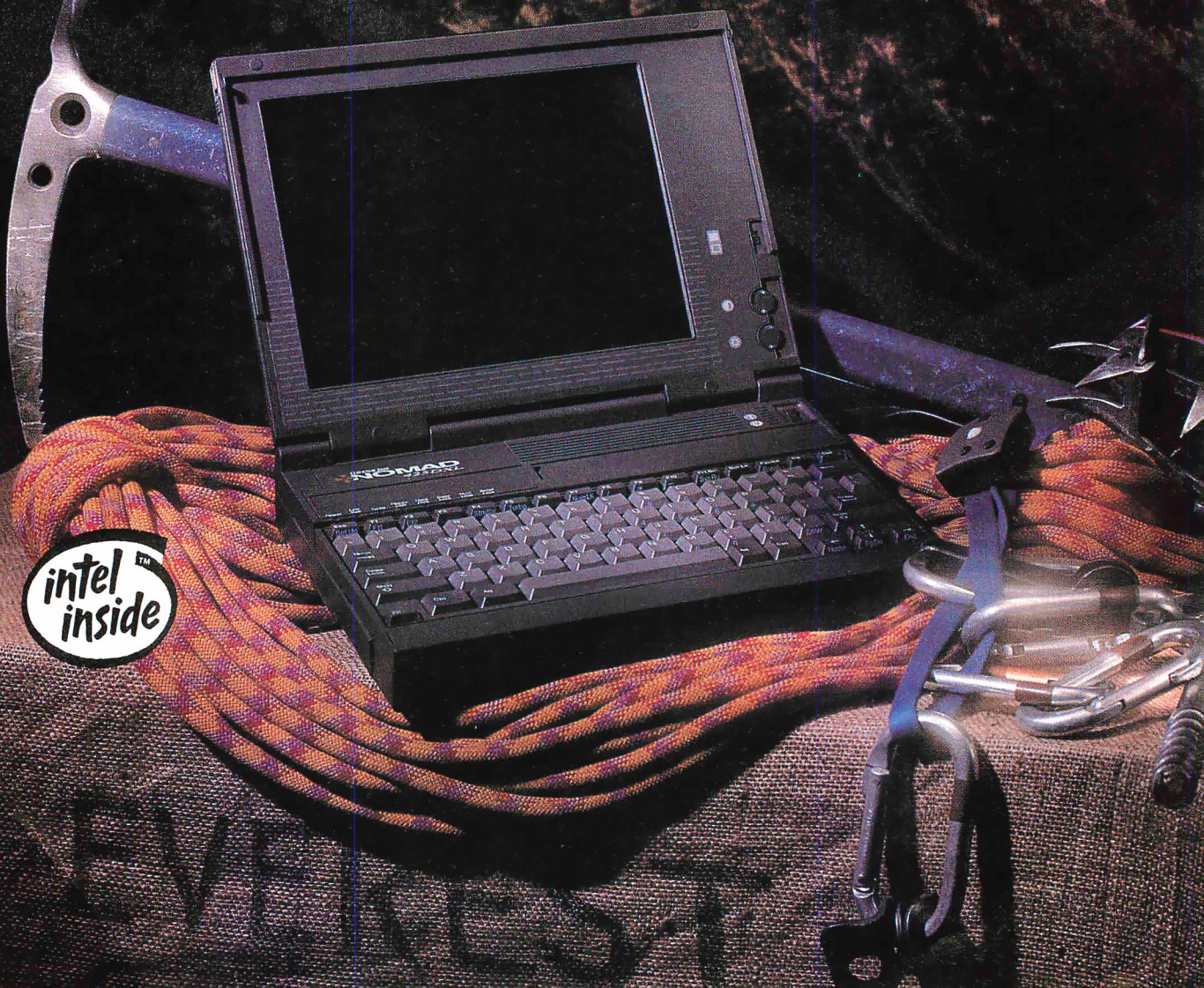
Base Camp



The Ascent



Reaching The Summit





Going to Extremes

If you want to know what the Gateway 2000 Nomad notebook PC can endure, just ask mountaineer Wally Berg. He took the Nomad 425DXL with him last fall on an expedition to the highest point on earth — the majestic, 29,128-foot Mount Everest in the Himalayan Mountains of Nepal.

Wally used the Nomad daily to track supplies, budget, and events of the climb. "Despite being transported over rugged terrain by yak, and operating in an unheated tent with temperatures outside of 20 to 30 degrees below zero, the Nomad performed flawlessly," said Wally. "The size was perfect, too. We had so many supplies to carry that size and weight were a big consideration."

Wally powered the Nomad with three sets of NiCad batteries which he recharged with a solar panel. Wally said the batteries weren't affected by the frigid temperatures. Each battery always lasted up to six hours.

The expedition left for its final climb to the Everest summit shortly after midnight on October 9. They ascended toward the peak by moonlight, reaching the top at 8 a.m. "It was a feeling of total exhilaration to finally reach the highest point in the world," said Wally.

Even if you don't plan to take your Nomad to Mount Everest, it makes the perfect traveling companion wherever you journey. The Nomad weighs just 5.6 pounds and measures 8.5 x 11 x 1.8 inches. Standard features include: a 25MHz Intel® 486SX or 486DX processor; 4MB RAM; an 80MB hard drive (425SXL model) or a 120MB hard drive (425DXL model); a 3.5-inch diskette drive; a 10-inch backlit VGA screen; a comfortable 79-key keyboard and FieldMouse™ portable pointing device; MS-DOS®, Windows™ and Works for Windows.™ Perhaps the most attractive feature is the price:

Nomad 425SXL ■ \$1995

Nomad 425DXL ■ \$2695

A Nomad gives you portability, 486 desktop performance, a great screen and keyboard, outstanding battery life — plus incredible durability. So take it from Wally Berg. If the Gateway Nomad can endure an Everest expedition, it can take almost anything!



8 0 0 - 5 2 3 - 2 0 0 0

610 Gateway Drive • P.O. Box 2000 • North Sioux City, SD 57049-2000
605-232-2000 • Fax 605-232-2023

©Gateway 2000, Inc. FieldMouse is a trademark of Gateway 2000, Inc. The Intel Inside Logo is a trademark and Intel is a registered trademark of Intel Corporation. Other brands and product names are trademarks or registered trademarks of their respective companies. Prices and configurations are subject to change without notice. Prices do not include shipping.

Voice/Fax for Windows

You can use Ibex Technologies' FactsLine for Windows software for document-retrieval applications such as customer service, literature fulfillment, and forms distribution. The interactive voice/fax package offers fax-on-demand, fax-broadcasting, and voice-processing functions that you can configure and implement in the Windows environment.

A pop-up scripting feature lets you compose and script the contents of voice announcements before you record them, and a simulation feature lets you test an application using the screen and mouse, instead of the telephone. The software also provides dated documents that automatically become inactive; on-line reconfiguration and updating of applications, voice announcements, and fax documents; a database-driven report generator; a visual voice editor; and document conversion tools.

FactsLine for Windows is also integrated with a voice-processing system to help direct calls through a multi-level voice-menus system. This interactive voice response transfers callers to the appropriate mailboxes and permits them to leave messages after they have retrieved their requested documents.

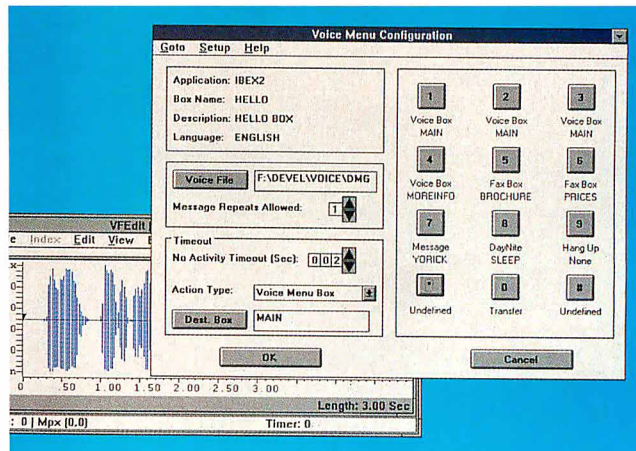
Price: \$6500.

Contact: Ibex Technologies, Inc., Placerville, CA, (916) 621-4342; fax (916) 621-2004.

Circle 1289 on Inquiry Card.

High-Speed Connectivity

Two high-speed connectivity products, the SunLink Frame Relay and the SunLink PPP, allow applications that



Ibex Technologies' FactsLine for Windows can handle fax-broadcasting and fax-on-demand transactions simultaneously without degradation.

you traditionally use on LANs, such as client-server databases, multimedia, the X Window System, and NFS (Network File System) applications, to run faster and more economically over global networks. You can also use both products with SunNet Manager to manage multivendor networks at local and remote sites.

The SunLink Frame Relay provides transparent IP connectivity to frame-relay networks over one or more links that can communicate at up to T1/CEPT speeds. You can have up to 1022 virtual point-to-point connections over each physical connection and obtain frame-relay virtual-circuit statistics.

The SunLink PPP allows communication at up to T1/E1 speeds between SPARC systems to extend beyond LANs to global networks. SPARC hosts can route TCP/IP traffic over point-to-point links by using the Internet PPP.

Price: \$1150 each.

Contact: SunConnect, Mountain View, CA, (415) 960-1300; fax (415) 969-9131.

Circle 1287 on Inquiry Card.

EISA-to-SCSI Disk Array Controller

The Ultra 124F, an EISA-to-SCSI disk array controller, supports up to eight logical arrays, each of which can be virtually any capacity and any RAID level. The full-length card can support up to 35 SCSI-1, SCSI-2, and Fast SCSI-2 hard drives; provides complete data redundancy using RAID levels 0, 1, 4, and 5; and comes with UltraArray, a utility that lets you configure multiple arrays of mixed types and capacities.

The basic card comes with three Fast SCSI channels that you can expand via the optional 124FEX daughter-board, which adds two channels internally, or the optional 124FXT/3 and 124FXT/5 expansion boards, which add, respectively, three and five channels externally to the computer. The Ultra 124F supports DOS, Windows, NetWare, OS/2, and Unix operating environments.

Price: Ultra 124F, \$1995; 124FEX, \$375; 124FXT/3, \$185; 124FXT/5, \$425.

Contact: UltraStor Corp., Fremont, CA, (510) 623-8955; fax (510) 623-8953.

Circle 1285 on Inquiry Card.

PCMCIA Fax Modems

With OmniTel's Business Card 2496c and 2496c+ PCMCIA Type II fax modem cards, you can send and receive Group 3 faxes at 9600 bps from your portable computer. Both modems are identical except that the Business Card 2496c+ adds flash memory, MNP level 10, and support for the Cellular Phone Interface.

Features include automatic fallback from 9600 to 7200/4800/2400 bps and from 2400 to 1200/300 bps; 2400-/1200-/300-bps data transfer; MNP levels 2-4 and CCITT V.42 error correction; and MNP level 5 and CCITT V.42bis data compression.

Price: Business Card 2496c with DOS software, \$349; with Windows software, \$375; Business Card 2496c+ with DOS software, \$399; with Windows software, \$425.

Contact: OmniTel, Inc., Fremont, CA, (510) 490-2202; fax (510) 490-1285.

Circle 1286 on Inquiry Card.

Micro Fiber Optic Transceiver

A compact adapter, the Transcast ENT-4322 Micro Fiber Optic Transceiver provides direct connection of Ethernet-based computers, servers, workstations, and peripherals to fiber-optic, 10Base-FL/FOIRL networks. The ENT-4322 features six diagnostic LEDs that indicate Jabber, Link, Collision, receive data, transmit data, and power, as well as a user-selectable Signal Quality Error switch.

Price: \$325.

Contact: Lancast, Amherst, NH, (800) 752-2768 or (603) 880-1833; fax (603) 881-9888.

Circle 1288 on Inquiry Card.



Thirteen reviewed. One winner.

IN REVIEW AFTER REVIEW, Jumbo takes top honors. PC Magazine's *exclusive* Editors' Choice is the 12th award in the last year. Which proves Jumbo is a backup value that can't be beat. Jumbo gives you top performance, yet it's easy to use. Choose either Jumbo 120 (120 MB with data

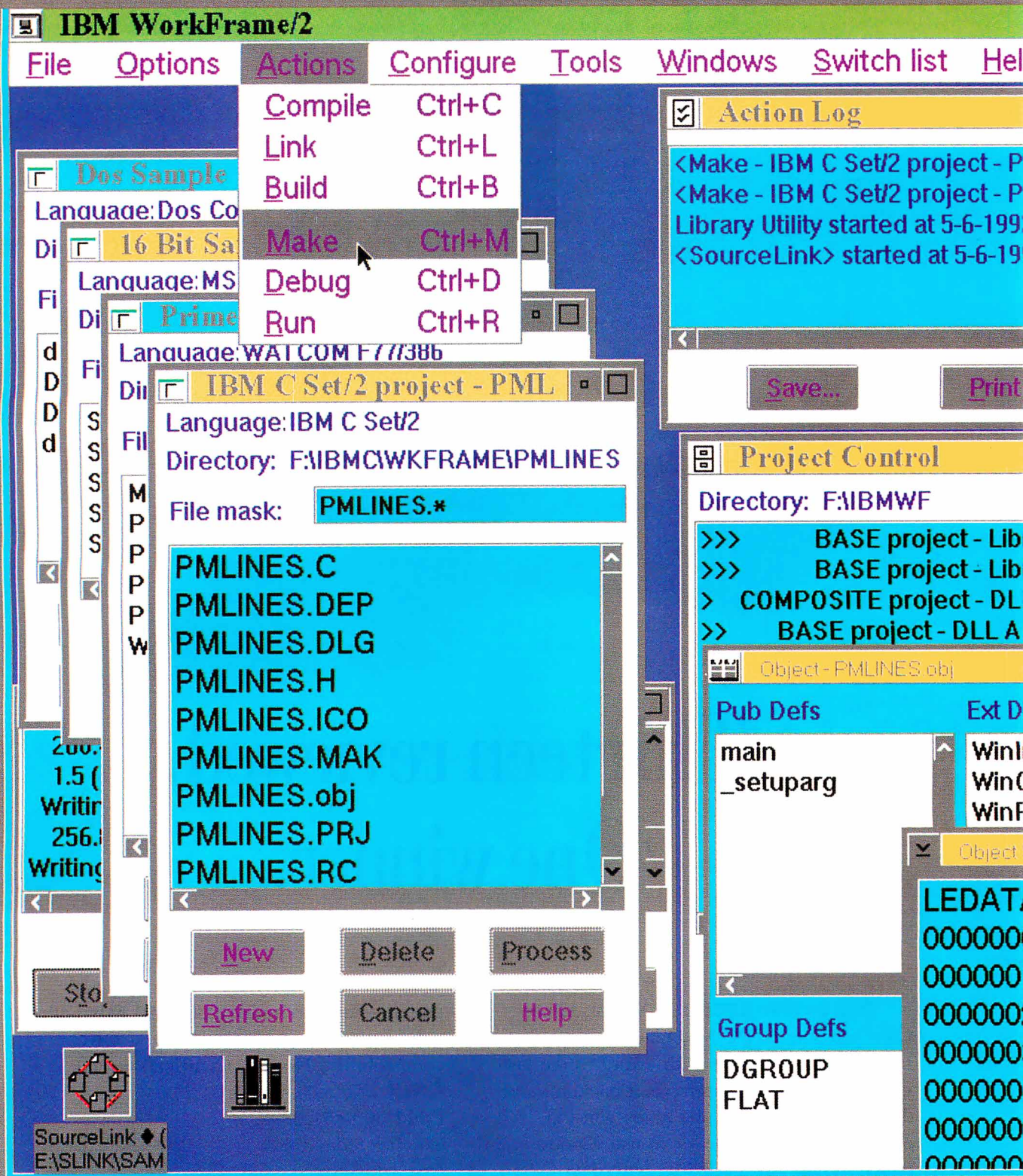
compression) or Jumbo 250 (250 MB with data compression). Both give you QIC compatibility, Novell® Certification and UNIX®/Xenix® support. Call 1-800-451-0897, ext. 163 today for a free brochure.



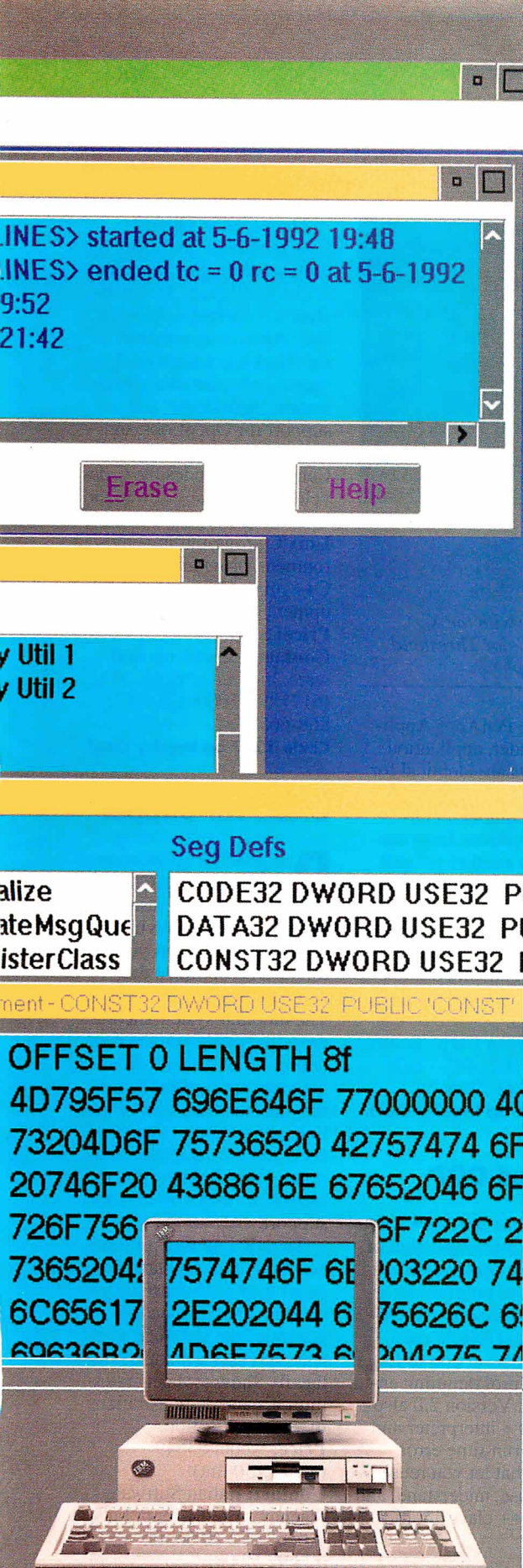
**COLORADO™
MEMORY SYSTEMS**
800 S. Taft Ave., Loveland, CO 80537

Novell, UNIX and Xenix are registered trademarks of their respective companies. © 1992 Colorado Memory Systems, Inc. All rights reserved

Circle 68 on Inquiry Card (RESELLERS: 69).



OS/2



To a software developer, this is what heaven looks like.

Most people wouldn't know what to make of a screen like this. But developers like you know a screen like this can help make all kinds of applications. With OS/2[®] 2.0, you can develop the DOS, Windows[™], OS/2 and host-based apps end users need. And you can do it faster and easier than ever before. Because OS/2 2.0 can make the most of your 386 or 486 processor.

Now you can edit in one window, compile in another, profile in a third and test in a fourth. Preemptive multitasking makes everything run smoothly and responsively. And OS/2 Crash Protection[™] helps shield running applications from each other, so if one goes down it won't affect the others. Instead of rebooting, you just restart the affected app and continue. And since OS/2 2.0 is a 32-bit operating system, programs are easier to write and run faster, too. Which all adds up to improved productivity and reduced development cycle time.

But maybe the best part is that for less than the cost of DOS and Windows, OS/2 gives you a whole lot more. And to keep your cycle rolling, a full range of services and support are available, like on-line help through OS/2 Support line, Bulletin Board and IBM Link. Or you can join the IBMOS2 and OS2DEV conferences on CompuServe[®], where you can meet IBMers, users and developers who can find fast answers to your questions. For an IBM authorized dealer near you, or to order OS/2 2.0 from IBM, call 1 800 3-IBM-OS2.*



- OS/2 Crash Protection helps shield applications from each other.
- The integrating platform of choice for DOS, Windows and OS/2.
- Preemptive multitasking for responsive, reliable execution.
- 32-bit flat address space for productive programming.
- A full range of IBM services and support.



Circle 89 on Inquiry Card.

GUI Tools for X Developers

With DynaGraphX, you can build Motif GUIs containing real-time graphs, meters, and dials, and generate all the Motif C code you need to implement your interface. The DynaGraphX package includes X-Designer, the DataViews Graph Widgets, the Color Threshold Table Editor, convenience functions, and sample programs.

A Motif GUI builder, X-Designer includes a layout editor, a WYSIWYG design window, and a widget selection palette. DataViews Graph Widgets contains 40 real-time graphs, meters, and dials; the Color Threshold Table Editor lets you tie color thresholds to your graphs; and the convenience functions simplify resource setting and object creation.

Price: DynaGraphX development license, \$7000.

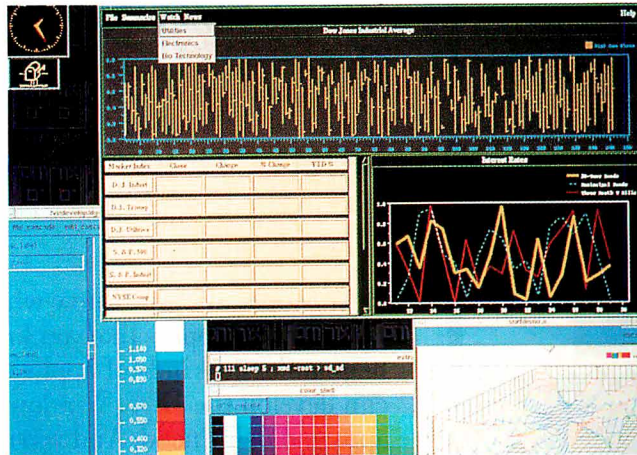
Contact: V.I. Corp., Northampton, MA, (413) 586-4144; fax (413) 586-3805.

Circle 1294 on Inquiry Card.

CASE for Windows

A CASE tool set for Windows, Visible Analyst Workbench 5.0 provides an integrated forward- and reverse-engineering environment that helps you through the planning, design, and analysis of the application development process. The package helps you generate SQL database schemata, COBOL source code, and C source code from designs you have developed in the system.

Visible Analyst Workbench includes multipage document support, model navigation improvements, control-bar support, reposi-



You can build a sample stock-watch window with the X-Designer, DataViews Graph Widgets, and Color Threshold Table Editor components of V.I.'s DynaGraphX.

tory data access, and text-editing enhancements. It also contains Windows features such as pop-up and pull-down menus, Clipboard-based data exchange with external applications, and support for Windows-compatible device drivers, color sets, and fonts.

Price: \$1895 and up.

Contact: Visible Systems Corp., Waltham, MA, (617) 890-2273; fax (617) 890-8909.

Circle 1295 on Inquiry Card.

Pen Application Builder

You can use the PenApps Application Builder 1.0 to create forms-based and data-intensive applications for pen-based computers. The package, which runs on Windows for Pen Computing and PenPoint, includes a screen/forms designer, a built-in database, and the Slate PenBasic programming language. You can build into your applications pen-centric features such as ink as a data type, input targeting, markup mode, switch to ink, deferred translation, gesture support, cursorless operation, coerced translation, and sketch fields.

With the PenApps Application Builder, application components are identical for both operating systems. You can move compiled PenApps applications from one platform to another yet still take advantage of operating-system-specific capabilities such as DDE under Windows for Pen Computing and Embedded Document Architecture under PenPoint.

Price: \$995.

Contact: Slate Corp., Scottsdale, AZ, (602) 443-7322; fax (602) 443-7325.

Circle 1296 on Inquiry Card.

C++ and OOP

CenterLine Software has added precompilation of header files, demand-driven generation of program information, and support for C++ templates to ObjectCenter 2.0, the latest version of its Unix C++ programming environment. Version 2.0 also offers a C++ interpreter and integrated run-time error detection that let you reuse code and use, understand, and develop C++ class libraries.

The package supports C++ templates, including the browser, debugger, and interactive workspace. It also includes enhanced debugging, fast object-code run-time error checking, advanced dynamic-code and data-visualization capabilities, and support for OpenLook and Motif. In addition, ObjectCenter 2.0 includes the C development capabilities found in CodeCenter, CenterLine's Unix C programming environment, providing a C and C++ mixed-language development capability.

Price: \$3995.

Contact: CenterLine Software, Inc., Cambridge, MA, (617) 498-3000; fax (617) 868-6655.

Circle 1297 on Inquiry Card.

CASE for Clipper

Designed for application development in Clipper, the dBsee (for database software engineering environment) package helps you automate and optimize the software development cycle. The modular system includes tools that guide you through definition of the data dictionary and application dictionary, prototyping and simulation, generation of source code and the database, compilation and linkage, documentation, and maintenance support.

The dB-Lan tool provides functions and templates for generating LAN-based applications. The dB-Doc tool generates the technical reference and user's manual, and the dB-Show tool generates tutorials and demonstrations of your application.

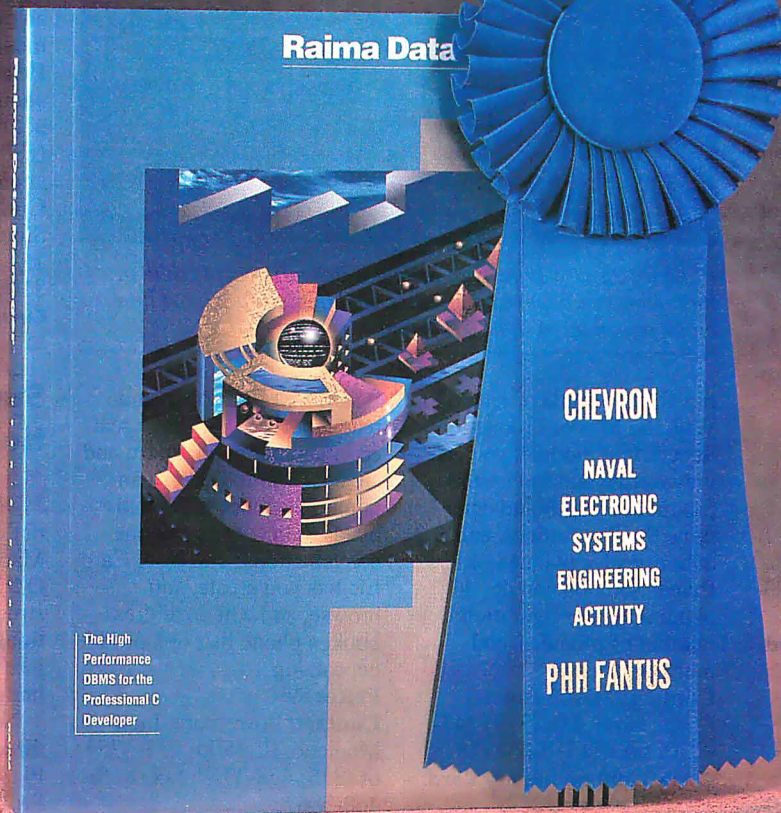
Price: About \$3549

(4,791,150 lira).

Contact: Italian Software Agency s.r.l., Baveno, Italy, +39 323 92 20 66; fax +39 323 92 52 08.

Circle 1298 on Inquiry Card.

Since when is Raima first in Corporate Database Development?



Since April 7, 1992

Raima Database Manager was the database of choice in the First Annual Windows World Open. The competition featured innovative custom applications built with Windows development tools. Three of the seven winners, and two of the finalists, used Raima Database Manager to solve their critical application needs.

For professional developers like yourself, Raima products offer:

- *High performance:* unmatched application speed.
- *Portability:* runs on DOS, Windows, OS/2, UNIX, VMS, QNX.
- *Royalty-free distribution:* increase your profits.
- *Source-code availability:* total programming flexibility.
- *Affordable pricing:* starting at just \$395.
- *Language support:* ANSI C, C++, and Visual Basic.

Listen to what some of our customers say about our products:

"No other products matched Raima for the price."

James Lisiak, developer, Chevron

"Raima provided us with speed, flexibility, and royalty-free distribution which allowed us to meet and exceed our customers' needs."

Dave Cooper, developer, Atlantic Research Corp,
(subcontractor, Naval Electronic Systems Engineering Activity)

"Database Manager gave us the edge we needed to handle large amounts of data quickly and efficiently within Microsoft Windows..."

Kelly Patrick, developer, PHH Fantus

If you're looking for an award-winning application development tool, give us a call. And discover the Raima advantage.

Raima Database Manager The high-performance DBMS
Raima Object Manager The object storage class library

Raima Corporation 1605 NW Sammamish Rd. Suite 200 Issaquah, WA 98027 (206)557-0200 Fax: (206)557-5200

1-800-DB-RAIMA Also available for DOS, OS/2, and UNIX

Copyright © 1992 Raima Corporation. All rights reserved.
BY23WA

Circle 127 on Inquiry Card.

Payroll Software for the PC

Version 2.0 of Industrial Strength Payroll automates weekly, biweekly, semimonthly, and monthly payrolls for up to 30,000 employees, who can be hourly, salaried, or 1099 personnel. The software can handle up to 999 companies and mixed payroll frequencies.

Multistate capabilities help companies that operate in more than one state to consolidate reporting. The multistate feature can also accommodate employees who are subject to taxes from more than one state. Industrial Strength Payroll can also process dependent care, excess group term life insurance, automobile insurance, and fringe benefits.

Price: \$245.

Contact: Phoenix Phive Software Corp., Scottsdale, AZ, (800) 331-1811 or (602) 483-0991; fax (602) 948-1379.

Circle 1299 on Inquiry Card.

Resource Planning

A Unix-based enterprise resource planning system for process manufacturers, ManBase 7.0 combines a client/server architecture, a relational database management system, and fourth-generation-language tool sets. The package includes inventory and production management, sales order management, and full financial capabilities. In addition, you can integrate ManBase with third-party floor-control management systems, electronic data interchange partners, CASE/CIM/CAD tools, and legacy systems.

The modular package lets you build and maintain components and their characteris-

Current Client Is The Phoenix Phive Test Company									
Time Entry Input Screen									
Key	2	ID	158	Jean-Paul Bissonett	SSN	002-00-2002			
Check Date 01/24/92									
AZ INCOME					NY INCOME				
Regular	20.00	=	300.00	Regular	15.00	=	225.00		
OT 1	2.00	=	45.00	Overtime	10.00	=	150.00		
F1-LIFE	0.33	=	10.00	F1-Life	2.50	=	25.00		
F2-DCARE	2.33	=	35.00	F2-Dcare		=	10.00		
DEDUCTIONS									
401(k)			Clothing	5.00	Other Ded	20.00	Garnish	15.00	
Medical	10.00		Union	7.50	Unid Way	6.00	Benefits	8.00	
Dental	12.00		Car	0.00			Field 28	12.00	
TAXES									
Federal	162.30	\$M11	32.46	\$M12	18.45	City 1			
FICA	50.10	\$D11	0.00	\$D12	0.00	City 2			
Medicare	11.72								
GROSS PAY		600.00	DEDUCTIONS		95.50	TAXES		275.63	NET PAY 436.07
F1 - Help F2 - Calculator F3 - Compute F4 - Exit									

Phoenix Phive's Industrial Strength Payroll accepts time in increments of hours and minutes, and it lets you import time-clock information in ASCII format.

tics for a formula or recipe. With the Master Production Scheduling module, you can view actual and forecasted product demands and determine the dates, times, and quantities for planned orders.

Price: \$60,000 and up, depending on configuration, number of modules, and number of users.

Contact: MAI Systems Corp., Novi, MI, (313) 347-9070; fax (313) 347-8958.

Circle 1300 on Inquiry Card.

TimeVision for Mac

The Mac version of the TimeVision personal information management tool gives you 24-hour scheduling at any level of detail with daily, weekly, and monthly windows. You can create multiday events and reliable repeating events over a specified time range.

The PowerEdit feature lets you describe events in an annotation box; designate the begin and end dates, the begin and end times, the type of event, and the frequency; and then set a reminder. With TimeVision's Memo feature, you can create, read, and save

ASCII text files; open and read text files you have created in another application; and create a Memo Folder containing business-letter templates or notes from phone conversations. The Note Card file lets you create, sort, browse, and edit an address book, a phone list, or a product catalog.

Price: \$99.

Contact: Powercore, Inc., Manteno, IL, (800) 237-4754 or (815) 468-3737; fax (815) 468-3867.

Circle 1301 on Inquiry Card.

PrismaOffice for Windows

PrismaOffice for Windows combines document processing with a database, links to external databases, and E-mail facilities. It includes a 180,000-word spelling checker and a 240,000-entry thesaurus. PrismaOffice for Windows accepts Prisma Language Modules, which let you switch the user interface among major European languages.

The software supports Microsoft's Multiple Document Interface, which lets you

open up to nine documents simultaneously. Support for Microsoft's OLE and DDE capabilities lets you link information from other files into PrismaOffice for Windows documents. The software automatically updates documents when you change an original file or file segment.

Price: Stand-alone version, about \$600 (£395); three-user network version, about \$1360 (£895); each additional user, about \$266 (£175).

Contact: Prisma Office, Ltd., Slough, Berkshire, U.K., +44 753 810899; fax +44 753 810903.

Circle 1302 on Inquiry Card.

Successful Negotiations

Negotiator Pro prepares you for all types of negotiations. The package (for the Mac, DOS, Windows, and OS/2) provides a logical and structured way to explore options, reconcile competing interests, and creatively brainstorm.

Negotiator Pro consists of three interactive parts: the Plan, the Hypertext, and the Profile. You use the Plan to tailor question-and-answer structures to your needs. The Hypertext section contains more than 350 terms, 15 international negotiation styles, 50 tactics, legal and business ethics, traditional and cutting-edge theory, and important figures in negotiation. The Profile section asks 11 questions about both sides in a dispute. It then analyzes the parties' negotiation and personality types, predicts the dynamics of the exchange, and advises you on how to approach each side.

Price: \$499 to \$648.

Contact: Beacon Expert Systems, Inc., Brookline, MA, (617) 738-9300; fax (617) 734-3308.

Circle 1303 on Inquiry Card.

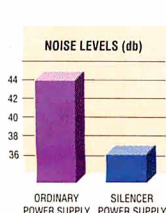
Cool, Quiet, Reliable Power.

STANDARD UNITS

These UL/CSA approved, fully-tested power supplies are the best basic units available.

STANDARD 200 XT	\$69
STANDARD 205 SLIM	\$89
STANDARD 220 BABY	\$89
STANDARD 220 AT/TOWER	\$89

ULTRA-QUIET UNITS

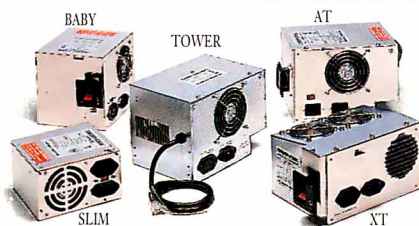


Unrattle your nerves with a Silencer power supply, recognized since 1986 as the industry's quietest. Cooled with efficient, variable-speed fans that are virtually inaudible!

A must for home office or multimedia applications.

SILENCER 205 SLIM	\$119
SILENCER 220 AT/TOWER	\$129
SILENCER 270 AT/TOWER	\$179

HIGH-PERFORMANCE UNITS



Upgrade your computer with one of our premium Turbo-Cool power supplies—the choice of PC professionals. You'll get 50% - 100% more power, built-in line conditioning, a dual-stage EMI filter, super-tight regulation, ultra-clean DC output, our high-capacity ThermoSense variable-speed fan (300W models), UL/CSA/TUV approvals, and a no-hassle 2-year warranty! Ideal for high-end workstations and network file servers.

TURBO-COOL 200 XT	\$159
TURBO-COOL 300 SLIM	\$169
TURBO-COOL 300 BABY	\$169
TURBO-COOL 300 AT/TOWER	\$189
TURBO-COOL 450 AT/TOWER	\$349

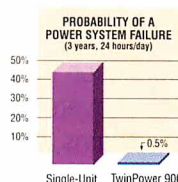
REDUNDANT POWER SYSTEM

Eliminate the risk of costly downtime or data loss due to power supply failure with the TwinPower 900 Redundant Power System. The system consists of two Turbo-Cool 450 power supplies in parallel, utilizing a special power-management interface module. You'll have the reliability of complete power redundancy for the entire network server.



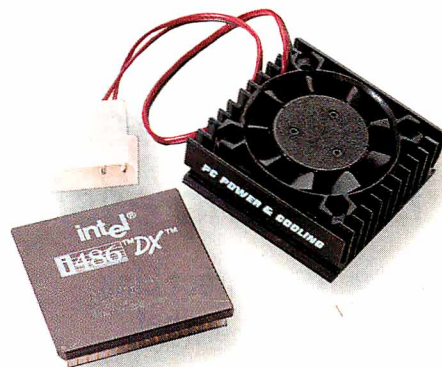
- **Super Server Power.** With 900 watts of peak power, the TwinPower 900 effortlessly runs any array of drives-- without the need for sequencing.
- **100 Times More Reliable.**

Why gamble with a single-unit system? TwinPower's load-sharing, redundant design lets you take the power system for granted. It's the peace-of-mind a network manager needs!

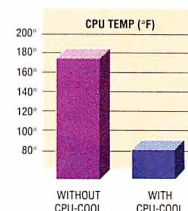


- **Hot-Swap Capability.** In the unlikely event that one of its 450s should fail, an alarm sounds, and the other 450 sustains the server while the user simply swaps in a new unit. No downtime!
 - **Optional Enclosures.** We offer "monster" cases that hold TwinPower's two power supplies and the interface. The Standard Model (51 lbs.) holds 13 drives, while the all-steel Industrial Model (104 lbs.) allows dual systemboards and holds up to 16 drives. Now, that's expandability!
- | | |
|-------------------------|--------|
| TWIN-POWER 900 | \$995 |
| W/STANDARD CASE | \$1695 |
| W/INDUSTRIAL CASE | \$1995 |

486 CPU COOLER



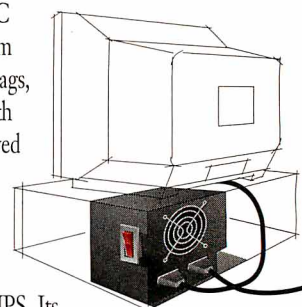
It's a fact that 486 chips run hot, often exceeding 185°F! Now, you can reduce the temperature of your 486 processor to a cool, safe 85° - 95°F with our CPU-Cool. You'll prevent random system errors and add years to the life of your valuable CPU. Consists of an ultra-quiet mini-fan embedded in a sculptured heat sink that easily mounts on the CPU. Powered by a spare drive connector. Effective, inexpensive insurance!



CPU-COOL	\$39
----------------	------

INTERNAL ON-LINE UPS

Protect your PC and its data from power surges, sags, and outages with our UL-approved InnerSource, a combined AT/Tower power supply



and On-Line UPS. Its auto-recharge battery provides up to 15 minutes of backup power for both your PC and monitor. This reliable, integrated protection costs less than an equivalent 550VA external UPS, and it saves space too! A Novell interface is available.

INNERSOURCE AT/TOWER	\$349
----------------------------	-------

PC POWER & COOLING, INC.

5995 Avenida Encinas, Carlsbad, CA 92008 • (619) 931-5700 • (800) 722-6555 • Fax (619) 931-6988

Most orders shipped same day. We accept Visa, MC, COD, or PO on approved credit. Turbo-Cool and TwinPower models guaranteed for 2 years. All other products guaranteed for 1 year. Hours: 7 a.m. - 5 p.m. (PT) Mon. - Fri.
©1992 PC Power & Cooling, Inc. Silencer, Turbo-Cool, ThermoSense, TwinPower, CPU-Cool, and InnerSource are trademarks of PC Power & Cooling, Inc. All other brand names are trademarks or registered trademarks of their respective companies.

Circle 115 on Inquiry Card (RESELLERS: 116).



Your Direct

BYTE introduces Your Direct Link – An enhanced service for BYTE readers that gives you free information on products – faster and easier!

In the NEW Direct Link section, here's what you'll find:

Alphabetical Index to Advertisers Including Phone Numbers

Now dial companies directly.



Product Category Index to Advertisers

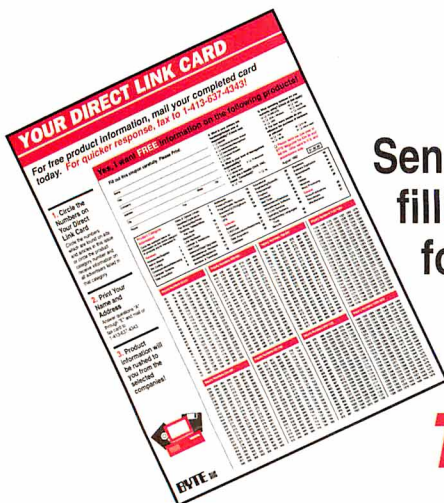
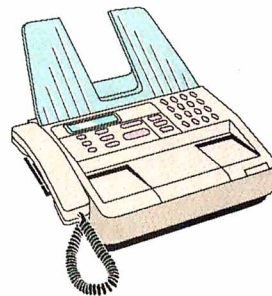
Order information on individual products or complete product categories.

Redesigned Editorial Index

Free information from companies covered in articles, columns, or news stories.

New Enhanced Direct Link Card

Receive free information quickly by filling out and mailing or faxing Your Direct Link Card today!



Send for FREE product information by filling out Your Direct Link Card found in the back of every issue.

Buy It Through BYTE!

BYTE 

Link to Products

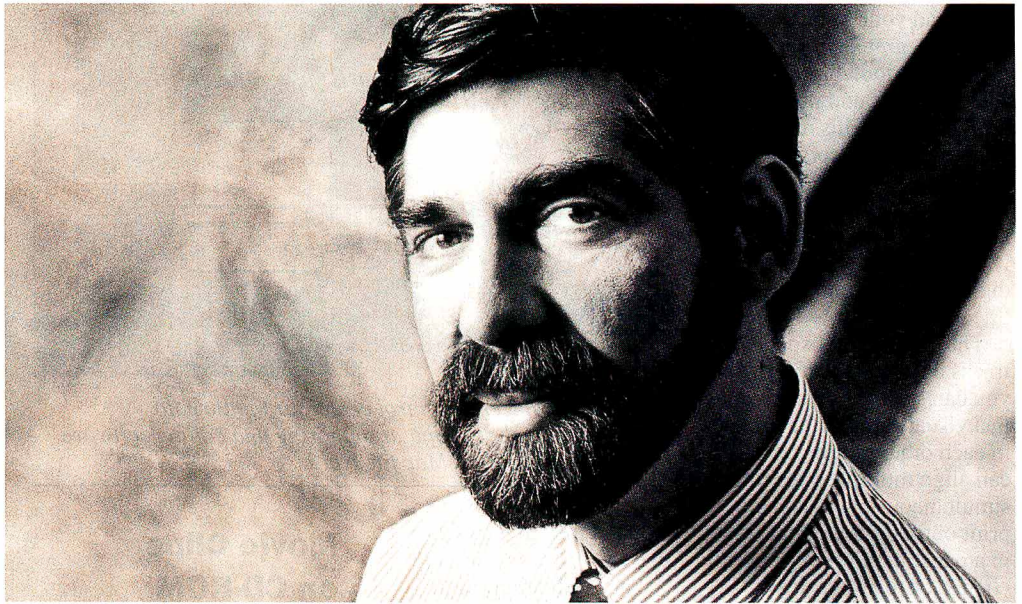
"I couldn't find a powerful CASE tool that was affordable. So I designed one."

JAN POPKIN, CHIEF SCIENTIST
POPKIN SOFTWARE & SYSTEMS, INC.

"I'm an engineer. And I know what it's like to need a high-performance and easy-to-use CASE tool. One that I could afford to place on every project team member's desk, not just a select few. That's why I developed System Architect™.

As Chief Scientist at Popkin Software, my role is to bring the real-world experiences of our developers to bear on the design and implementation of the best CASE tool possible. System Architect is the result.

It's also the result of listening to our more than 10,000 users. We take your advice because we know it's real. Then we incorporate it and feed it back to you in real-world solutions and new product innovations."



Low Price. High Performance.

Since its introduction in 1988, System Architect (SA) has proven that many of the features offered by more expensive CASE tools are available for a fraction of the cost. There are now more than 10,000 SA copies in use at 2,500 installations worldwide.

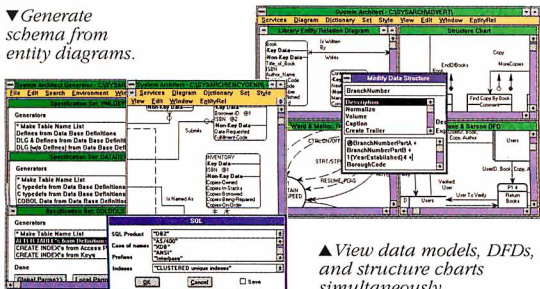


MICROSOFT
WINDOWS.

Quick and Easy.

System Architect works on IBM® and IBM-compatible PCs running MS Windows® and OS/2 PM®. It comes with an integrated data dictionary that users can customize to meet their needs. Project personnel can easily share information both on and off a network. It's so user-friendly

▼ Generate schema from entity diagrams.



▲ View data models, DFDs, and structure charts simultaneously.

Multiple Choice.

System Architect works with multiple methodologies: Yourdon/DeMarco, Gane & Sarson, Ward & Mellor (real-time), Booch, Shlaer/Mellor (OO), Coad/Yourdon, Information Engineering and SSADM. And diagram types and charts including: DFDs, Entity Relation diagrams, Decomposition diagrams, State Transition diagrams, Structure Charts, and Flow Charts.

The Power To Grow.

To respond to advances in technology such as Client/Server Architecture, SA continues to grow in functionality and productivity. A few optional modules now offered are:

SA Schema Generator: Translates entity models from the encyclopedia into schema for DB2, Oracle, Ingres, SQL Server, Rdb, PROGRESS, Paradox, SQL Base, AS400, (SQL & DDS), Interbase, OS/2 DBMS, dBASE III, XDB, SYBASE, and Informix. Generates Windows DLGs, and C type data definitions or COBOL data structures.

SA Screen Painter: Develops screens for GUI or character-based applications, which are

automatically populated from your SA Data Dictionary/Encyclopedia; generates MS Windows dialogs and Microsoft or Microfocus COBOL Screen Sections.

SA Object Oriented Analysis & Design (OOA/OOD): Supports Booch 91 and Coad/Yourdon.

SA Network Version: Diagram and data dictionary record locking allows multiple project members to work concurrently on the same project.

Built for Engineers.

SA also has other advantageous features: automated documentation; extensible data dictionary; normalization, rules and balancing; requirements traceability; import/export; custom reporting; and CRUD Matrices.

**Call us toll-free today at
800-REAL-CASE, x109.**

To find out how to qualify for your free 30-day evaluation copy, simply call us today or fax us at 212-571-3436.



SYSTEM ARCHITECT

Popkin Software & Systems, Inc.,
11 Park Place, New York, NY 10007
England 44-926-881186; Benelux 31-3406-65530;
Germany 49-6151-82077; Italy 39-49-8700366;
Australia 61-02-346499; Sweden 46-8-626-8100;
Switz. 41-61-6922666; Denmark 45-45-823200.

Create Presentations

With Passport Producer and your Mac, you can easily integrate and synchronize animation, digital video, sound, music, and presentation graphics. This multimedia presentation-software package lets you add sound tracks to QuickTime movies and animations and accurately synchronize to MIDI or digital audio using the Cue Sheet feature.

The Cue Sheet displays all tracks and time locations, so you can see the events or cues in a visual form as they relate to each other in time. You can align multiple cues for simultaneous playback and print out the Cue Sheet to use in a paper edit, to review with clients, or to aid in storyboarding. Passport Producer lets you import cues in TEXT, PICT, PICS, or QuickTime file formats.

Passport Producer displays the final presentation on a user-customized stage. You can position visual elements and arrange multiple objects on the stage in an unlimited number of ways. The package also lets you display presentations on two or more monitors simultaneously.

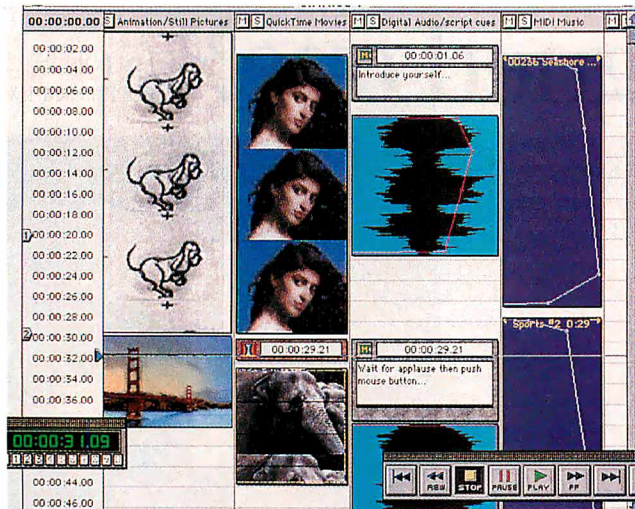
Price: \$495.

Contact: Passport Designs, Inc., Half Moon Bay, CA, (415) 726-0280; fax (415) 726-2254.

Circle 1305 on Inquiry Card.

Sound and Music for Windows

The AudioView package contains three applications for Windows that let you control the digital-audio and CD-ROM functions of PC sound cards and multimedia PCs. The applications are AudioView, the Voyetra Audio Mixer for Windows



Passport Producer, a control center for multimedia productions, links to popular authoring and editing software that imports standard Mac file types.

3.0, and the Voyetra CD Player.

The AudioView digital-audio editor records, edits, and plays music, narration, or sound effects as digital-audio files stored on your computer's hard drive. The file display window gives you a graphical view of the entire file or lets you zoom in for a closer look—as close as a single sample.

With the Voyetra Audio Mixer, you can control the volume levels of most types of sound. You can preset levels before recording or playing, or mix them during operation for perfectly balanced sound tracks.

The Voyetra CD Player helps you name and catalog disks to facilitate locating and playing a CD track. The Playlist feature lets you assemble and play a series of CD audio tracks in any order. Or, you can let the CD Player's Shuffle feature play tracks in random order.

Price: \$129.95.

Contact: Voyetra Technologies, Pelham, NY, (914) 738-4500; fax (914) 738-6946.

Circle 1308 on Inquiry Card.

Movie Clips on CD-ROM

The Action CD-ROM comes with clips for QuickTime for Windows, complete with Apple Computer's Movie Player for Windows, QuickTime DLLs, and Windows Picture Viewer. You can play Action's four categories of movie clips from the CD-ROM or copy them to your hard drive.

Movie categories include historical, modern, music video, and sound-only movies. Also included are 3-minute segments of MTV-style music videos. The Action CD-ROM also contains high-quality pictures that you can display, zoom, and scroll using the Picture Viewer.

Price: \$89.95.

Contact: The San Francisco Canyon Co., Inc., San Francisco, CA, (415) 398-9957; fax (415) 398-5998.

Circle 1306 on Inquiry Card.

Entry-Level Multimedia

Now nontechnical users can enter the world of

multimedia with UCM's MM Box 2 multimedia production software package. The package lets you bring together analog and digital video, graphics, images, 2-D and 3-D animation, and stereo sound.

Two versions of MM Box 2 are available: a 3½-inch floppy disk version and a CD-ROM version. The CD-ROM version includes 125 animations; an Image Photo Library containing 250 BMP digitized images and 750 thumbnail images; 25 minutes of original music; 45 sound effects; and MM Browser software, which lets you search through the elements.

Price: Floppy-disk version, about \$190 (£125); CD-ROM version, \$454 (£299).

Contact: UCM, Ltd., Hove, East Sussex, U.K., +44 273 208103; fax +44 273 774064.

Circle 1307 on Inquiry Card.

Sound-Editing Software

Digital Soup Sound Professional lets you edit and mix as many as 16 tracks of imported sound files or sounds recorded from a CD-ROM, microphone, or other player device that can interface with your sound board. The editor offers functions such as cut, paste, copy, and delete, and imports and exports standard Windows audio files. It is an OLE server.

You can choose various sound effects, including fade-in, fade-out, modulate, compress, reverse, repeat, and delay. You can also view and modify the frequency content of your sound with Digital Soup's 3D Spectral Analysis and its four-band parametric equalizer.

Price: \$99.

Contact: Digital Soup, Inc., Brattleboro, VT, (802) 254-7356; fax (802) 254-6812.

Circle 1309 on Inquiry Card.



IMAGINE BROWSING THROUGH THE LIBRARY OF CONGRESS AT 1500 MPH.

That's how quick the world's fastest CD-ROM drive moves you through volumes of information.

The new Pioneer DRM-604X Minichanger is TWICE AS FAST as any drive on the market. It has a data transfer rate FOUR TIMES the normal speed. And it holds SIX discs at once — more than any other drive.

High speed data transfer rate is an astounding 600 KBytes/sec. High speed access time averages 300 msec.

Change time between discs has been reduced from seven to five seconds.

If six discs are not enough, you can daisy-

chain up to seven Minichangers from a single controller, giving access to 42 discs — more than 5 million pages of data.

The greatest amount of information at the greatest speed. It makes so much sense, it's hard to imagine why anyone would even consider any other drive.

For more information, call 1-800-LASER-ON today.

Or write to Pioneer Communications of America, Inc., Optical Memory

Systems Division, 3255-1 Scott Blvd., Suite 103, Santa Clara, CA 95054.



**THE PIONEER HIGH SPEED
CD-ROM MINICHANGER**



Geometry Solver for Pen PCs

Now you can use your pen-based computer as a geometry collection station with Saltire Software's SketchRight. You sketch in the geometry and enter the distances or angles you want to measure. SketchRight gives you an accurate to-scale representation and then calculates unknown distances, angles, and areas measured from the scale drawing.

SketchRight also includes two-way .DXF links, which let you communicate with most standard CAD packages, and two-way DDE communication and Clipboard support, which lets you communicate with other Windows for Pens applications.

Price: \$249.

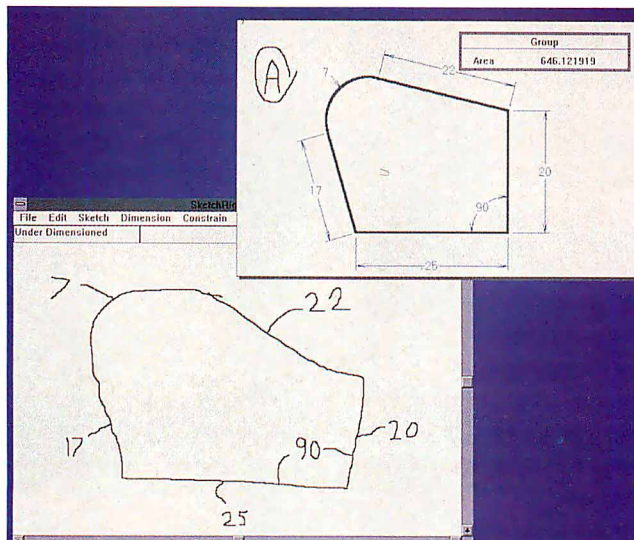
Contact: Saltire Software, Inc., Beaverton, OR, (503) 622-4055; fax (503) 622-4537.

Circle 1310 on Inquiry Card.

Windows File Utility

Systems Compatibility has added to Outside In 2.0 for Windows support for graphics and compressed files, file management, and the ability to integrate the software into Windows E-mail programs to view attachments. You can use the file-viewing and data-import utility with E-mail programs, word processors, and BBS files, or anytime you need to look at a file.

The package lets you view files from more than 90 DOS, Windows, and Mac formats; launch applications from a file view; copy data to the Clipboard for use in other Windows programs; combine data from word processors, spreadsheets, and databases;



SketchRight by Saltire Software combines a sketch-based drawing package with an embedded Constructive Variational Geometry engine to create a two-way link between the geometry and a mathematical equation solver.

and search across directories, drives, and networks by filename, file type, file extension, or text string. The Tear-Off feature lets you view multiple files at one time, and the Text Search feature lets you search a document or file list for specific words or phrases.

Outside In recognizes and displays more than 120 file types from DOS, Windows, Mac, DEC, and Wang programs and lets you paste graphics, text, spreadsheet, or database files from DOS, Windows, and Mac programs into the mail edit window. It also integrates directly with cc:Mail, Microsoft Mail, WordPerfect Office, and Da Vinci eMail.

Price: \$89.

Contact: Systems Compatibility Corp., Chicago, IL, (800) 333-1395 or (312) 329-0700; fax (312) 670-0820.

Circle 1311 on Inquiry Card.

SPREAD THE WORD

Please address new product information to New Products Editors, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. Please include a product description, price, ship date, and an address and telephone number.

Turn Your Mac into a Dictaphone

With the Useful Voice Processor, you can turn your sound-capable Mac into a fully functional dictation machine. In environments where typing or mousing is not appropriate, this software-only product lets you dictate a letter, compress it, and store it on disk with one-finger operation.

The package uses Apple's MACE (Macintosh Audio Compression and Expansion) technology to compress the sound as you record it, and a proprietary silence elimination algorithm automatically cuts out the pauses when you speak. A transcription function lets you type text while the program is playing back the recorded sound. The Useful Voice Processor stores the transcription in a separate document from the audio, and

it is fully compatible with most word processors.

Price: \$179.95.

Contact: Useful Software Corp., Beverly Farms, MA, (508) 922-7272; fax (508) 922-0413.

Circle 1312 on Inquiry Card.

Protect Your Unix System

Woodside Technologies' Fortress package is a GUI-based security program with antivirus protection for Unix. Using a point-and-click interface, the program provides Unix users and system administrators with four security modules that run from a central menu. The security modules include the Trojan Horse Detector, the Worm-Proofer, the File Inoculator, and the Password Cracker.

The Trojan Horse Detector searches the user's path, the entire system, or any system portion you specify to locate duplicate copies of common Unix commands. The Worm-Proofer detects and eliminates weak-security entry points that might allow unwanted programs to log onto a remote system through network connections and replicate themselves.

The File Inoculator searches files and adds a unique fingerprint in an encrypted format without changing the files. The fingerprints are stored in a secure database, which automatically scans files at user-specified time intervals. The Password Cracker module attempts to crack all passwords to ensure that those that are easy to guess do not threaten the security of the system.

Price: \$495.

Contact: Woodside Technologies, Inc., Sunnyvale, CA, (408) 733-9503; fax (408) 732-7335.

Circle 1313 on Inquiry Card.

Get the new skills you need for a high-paying career in computer programming!

Only NRI at-home training gives you real-world programming skills in three in-demand languages: QBasic, C, and Visual Basic, today's hot new language designed for writing popular Windows applications. Best of all, you get hands-on training with a powerful new 486sx-based computer system, complete with 80 meg hard drive, Windows, and professional programming software you keep!

► NRI, the recognized leader in at-home computer training, shows you how to take advantage of today's newest programming opportunities

Get in on the ground floor of one of today's fastest-growing career fields: computer programming.

The Bureau of Labor Statistics forecasts that job opportunities for programmers will increase *much* faster than average over the next 10 years, with as many as 400,000 new jobs opening up by 2005.

And the fastest-growing segment of programming jobs will be PC programming, fueled by the phenomenal popularity of Windows, the efficient power of C, and the ascent of exciting new languages like QBasic and Visual Basic.

Now, with NRI at-home training, you can get the new skills you need to build a top-paying career — even a full- or part-time business of your own — in this high-growth, high-opportunity field.



**ALL-NEW!
486sx Computer,
Plus Windows
and
Visual Basic!**



code, run, debug, and document programs in QBasic, C, and Visual Basic. Best of all, since Visual Basic is specifically designed for creating Windows applications, you learn to generate fully functioning Windows programs, complete with text boxes, command buttons, and other sophisticated graphical interface elements.

► No previous experience necessary

Train with NRI, and immediately start getting the money-making job skills you need to be a computer programmer — no matter what your previous background.

NRI's step-by-step lessons and hands-on programming projects help you first master the programming design concepts used every day by successful PC programmers. With your

experienced NRI instructor on call and ready to help, you go on to learn programming in three of today's hottest languages.

By the time you complete your course, you have a clear understanding of programming methods, languages, and techniques...and you're ready to handle any programming task with confidence.

employers and clients demand... including programs designed for use in a Windows environment!

Only NRI gives you first-hand programming experience with a state-of-the-art 486sx mini-tower computer system, complete with hard disk drive, a full megabyte of RAM, high-density floppy drive, mouse, monitor, and more — all yours to train with and keep!

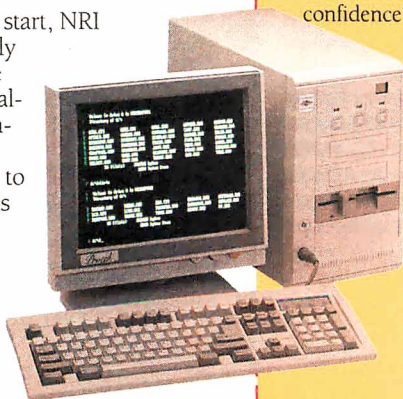
Plus you explore the extraordinary capabilities of *three* in-demand programming languages. You learn to design,



See other side for highlights of your NRI hands-on training in computer programming →

► NEW! The only programming course that includes a powerful 486sx-based computer, 80 meg hard drive, Windows, Visual Basic, and more — all yours to keep!

Right from the start, NRI gets you actively involved in the challenge of real-world programming. Step by step, you learn to create the kinds of full-featured, powerful programs today's



SEND CARD TODAY FOR FREE NRI CATALOG!

NRI Schools

McGraw-Hill Continuing Education Center
4401 Connecticut Avenue, NW, Washington, DC 20008



For career courses approved under GI Bill, ☐ check for details

YES! Send me the FREE catalog I've checked and show me how NRI can give me the skills and confidence to earn good money in an exciting new career or business of my own.

✓ Check one free catalog only

- ☐ Computer Programming
- ☐ PC Applications Specialist
- ☐ Programming in C++ with Windows

Other Computer Career Opportunities

- ☐ Microcomputer Servicing
- ☐ Desktop Publishing
- ☐ Bookkeeping and Accounting
- ☐ Computer-Aided Drafting

Name (please print) Age

Address

City State Zip

Accredited Member, National Home Study Council

5448-0293

Learn computer programming as you train with the latest programming tools... a 486sx-based computer system, Windows, Visual Basic, and more!

"I couldn't believe NRI gives you a computer, loads of reference material, and professional software.

The course has taken my knowledge of computers and my self-confidence to new levels!"

Rob A. Chappa, NRI Student

All New!

► Now, as never before, you can succeed as a computer programmer

NRI at-home training gives you everything you need to build a high-paying career as a computer programmer. Designed around a state-of-the-art 486sx computer system, your training guides you smoothly from fundamental principles through coding in three of today's most widely used computer languages: QBasic, C, and Visual Basic, the language designed specifically

for programming in a Windows environment.

With NRI, you get the hands-on experience and the confidence it takes to master today's programming challenges. And, by creating and running your own full-length programs, you build skills you'll be proud to show any prospective employer or client.

► Send today for your FREE catalog

Prepare now for a high-paying career as a computer programmer! See how NRI at-home training in Computer Programming gives you the experience and the know-how, the computer and the software you need to get a fast start in this top-growth field. Send today for your FREE catalog.

If the card is missing, write to us at NRI Schools, McGraw-Hill Continuing Education Center, 4401 Connecticut Avenue, NW, Washington, DC 20008.

IBM PC/AT is a registered trademark of the IBM Corporation. Windows, QBasic, and Visual Basic are trademarks of Microsoft Corporation.

Card 72

Here's what makes your 486sx mini-tower computer system the ideal programming tool:

- Full IBM PC/AT-compatibility
- High-speed 80486sx CPU with 25 MHz clock
- 80 megabyte hard disk drive
- 1 meg RAM (expandable on board); 64K ROM
- Windows graphical interface
- 14" high-resolution monitor with tilt-swivel base
- 1.2 meg, high-density 5 1/4" floppy disk drive
- MS-DOS operating system with QBasic Interpreter
- Professional compilers for programming in C and Visual Basic

BUSINESS REPLY MAIL

FIRST CLASS MAIL PERMIT NO. 10008 WASHINGTON, D.C.

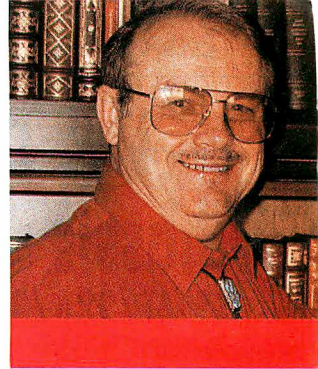
POSTAGE WILL BE PAID BY ADDRESSEE

NRI Schools

McGraw-Hill Continuing Education Center
4401 Connecticut Avenue, NW
Washington, DC 20078-3543

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES





JERRY
POURNELLE

LAN WARS

They're doing it to us again. Back in the early 1980s, the first big boom in small computers was stalled when the U.S. government created a cartel to force the Asian suppliers to charge us a lot more for memory; that, in turn, drove up the price of cheap clones, with the result that we all paid more for our machines. Unfortunately, it's happening again: government actions are driving memory costs up. This means fewer computers will be sold, meaning less software sold, meaning a slowdown in our industry's growth. So it goes.

Bits Ain't Bits

Windows likes a large amount of memory. It's true enough that you can run Windows with 4 MB, and I do that on my laptops; but when I'm home, I like to have a lot of windows open at once. Typically I'll have Norton Commander, Franklin Ascend, Q&A, Q&A Write with Word Finder and the Definitions Plus American Heritage Dictionary, Word for Windows, a CD-ROM window, and probably a communications program open at all times.

From time to time, I bring in other stuff, like word processor format converters, accounting and bookkeeping systems, and new programs I'm trying out for the column. Add all those up, and 8 MB isn't too much. Bring in a programming language—Visual Basic or Borland Pascal in my case—and a drawing program for doing maps for my stories, and it strains that 8 MB to the limit.

Indeed, at 8 MB I ran out of resources often enough that I decided my primary system ought to have 16 MB. That caused a minor problem most people wouldn't have: what is my main system? What makes this column different is that I *use* the stuff I write about, so unless I'm going to write about one machine and one only, I have to keep swapping systems around. That's part of the fun, of course, but it also means that I needed more memory for several machines, not just one. Still, I thought, memory is cheap. I ordered 20 MB, which I figured would cost under \$1000. My intent was to put it in my various machines, and when it was time to send those machines back, I'd just take my SIMMs out and use them again in whatever new systems replaced them.

Wrong on two counts.

First, memory used to be cheap; but then my government helped me by threatening high tariffs on Korean imported memory. The price of memory just about doubled in a week, and as I write this, it doesn't look like it's

coming down soon. I suppose it shouldn't surprise me. Every time the clone makers have threatened the big companies in clone wars, the government has intervened to keep computer prices high; why not this time? Of course, that plus the FCC regulations kills off U.S. start-ups before they're born while helping overseas competitors, but so it goes. Anyway, my 20 MB cost considerably more than I'd intended.

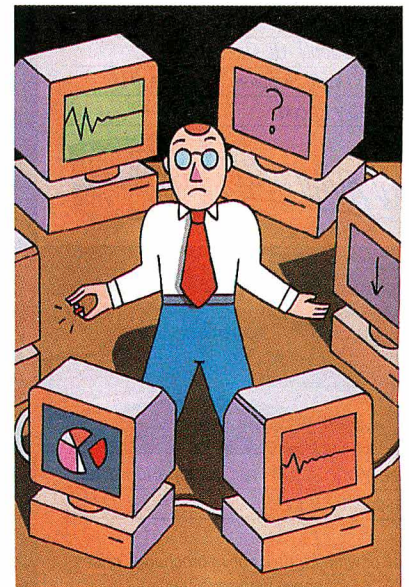
Second, memory for one system may not work in another. Example: I have two Gateway 2000 systems. We love them. One is a 486DX2/50, and the other is a 4DX2-66V. The 486DX2/50 uses conventional SIMMs, and Alex quickly upgraded it to a 20-MB system. The 4DX2-66V, on the other hand, uses an entirely different configuration, one Alex and Barry Workman had never seen before, and I'll have to get memory for that one directly from Gateway (they sell it at reasonable prices). Meanwhile, I find, my Cheetah 486/33 uses yet another memory form factor, and that was even trickier to find.

The result is I have some expensive memory I can't use. It's not a disaster. I can always find places to put memory—caching drive controller boards, older systems I've donated to schools—but it is annoying, and the moral of the story is, memory isn't standard, and what looks like a bargain may turn out not to work in your machine. Pournelle's law: if you don't know what you're doing, talk to dealers who do. I didn't, and I should have.

This Time for Sure

Every year we hear that this will be the Year of the LAN. What with Microsoft pumping millions into advertising Windows for Workgroups, and every other LAN maker jumping onto the network bandwagon, this may really be it. Anyway, after several false starts, 1993 certainly is

Windows for Workgroups and LANtastic for Windows duke it out at Chaos Manor



MINUTEMAN TAKES CHARGE IN OVER 1000 JCPENNEY STORES.

Every time JCPenney sells a pair of jeans, a toaster or a bottle of perfume, MINUTEMAN takes charge. That's because more than one thousand JCPenney stores rely on MINUTEMAN UPS systems to back up power to their point-of-sale systems.

Every day your company relies on its voice and data communications equipment to stay productive. Unfortunately, the electricity that powers these vital systems is not reliable.

Blackouts, brownouts, spikes, surges and even lightning strikes are common in most business environments. And the high

cost of losing vital information and productivity due to power outages and surges calls for preventive measures.

Power requirements can be confusing. And your company has unique needs that often require

custom solutions.

MINUTEMAN PRODUCTS:

- On-line and standby UPS 300VA to 10KVA
- Shutdown software for every available operating system
- Automatic voltage regulators
- Surge suppressors
- International models
- Two year warranty

Call our toll-free POWER HOTLINE now for your free Power Protection Guide.

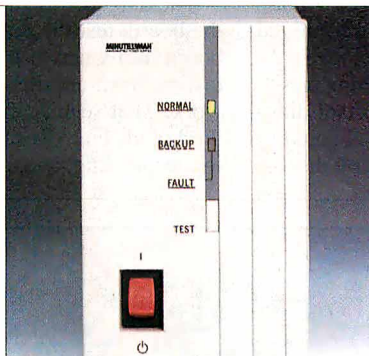
(800) 238-7272

MINUTEMAN®
UNINTERRUPTIBLE POWER SUPPLIES

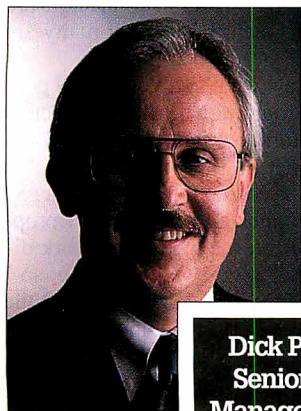
Reduced prices
up to 36%

Call for complete price list.

MINUTEMAN
Alliance
300VA
\$159



MINUTEMAN
Alliance
425VA
\$259



Recently JCPenney Co., Inc. changed its operations from the old POS systems to the new PC-based technology, relying on PC platforms for point-of-sale and in-store support. And they back each

Dick Patefield,
Senior Project
Manager for Store
Systems Support,
JCPenney

one up with help from MINUTEMAN.

"There was a violent surge in one of our stores," says Patefield. "If we didn't have the MINUTEMAN unit, it probably would have seriously damaged all of our point-of-sale equipment."

"The key was the switch-over time from AC to battery," says Patefield. "It really has the best continuity of the UPS systems we evaluated. Also, the price was very favorable. When you're installing them in as many locations as we are, the pricing was very attractive."



Circle 114 on Inquiry Card.



and intuitive. There was one problem: I couldn't access anything across the network.

Terminate with Prejudice

All this was late at night, with this column due. Since the WFWG software seemed to be working just fine, I figured the problem was hardware; so the first thing was to exit Windows and run the Softset diagnostic programs. Unfortunately, I couldn't do that. Softset works only if you disable

all network drivers and reboot. Well, all right, go into CONFIG.SYS and REM out all the device drivers WFWG had installed—there were several—and then reboot and try Softset again.

The diagnostics had three options: test the board, test the network, and turn this board into a network responder to allow testing from another station on the network. That seemed simple enough. Test the board. Fine. Test the network: nothing responding, and after a while it said I

should check the cable. Fine. Go to the other machine, disable all network device drivers, reboot, run Softset, test the card—it's fine—and configure that as a network responder.

Alas, no joy. Check the cable. Use an ohmmeter to check continuity. Seems OK to me. Reconnect. Still nothing. I ground my teeth, wrote some other stuff for the column, and went to bed.

At this point, experienced Ethernet users are laughing their heads off, so I'll finish this story quickly. I got on-line to BIX and asked for help; within an hour, Jeff Sloman sent a note asking if I had properly terminated my Ethernet cables. Since I had no idea what *termination* meant, clearly I hadn't; time to call Barry Workman for some elementary instructions.

Ethernet thin-wire systems connect in a daisy chain, each machine connected to the next, so what connects to the board in each machine is a T connector. Since I had only two machines in this loop, I hadn't known that I needed to connect them using T connectors, but that was the trouble. At each end of a thin-wire Ethernet system there must be T connectors, with a little metal 50-ohm terminator cap on one branch of the T. Moreover, not all terminator caps are 50 ohms: ARCnet terminators are 96 ohms, and there are other values. In theory, the 50-ohm connectors are color-coded green, but in fact many are bare metal.

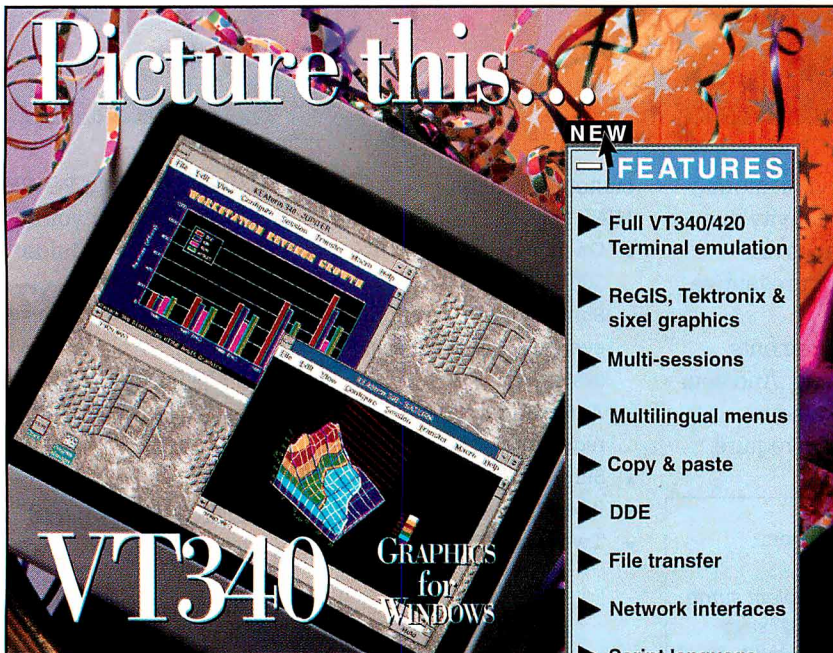
Once I knew what to do, it was all pretty simple. I found a pair of T connectors and terminators that had come with Artisoft's Ethernet Starter Kit, tested with a multimeter to see that they were in fact 50 ohms, and connected the machines properly. When I ran the Softset network diagnostics everything was just fine, so I edited the CONFIG.SYS files to put the device drivers back in, rebooted, started up Windows, and—voilà!

Well, not quite, because I hadn't un-REMed all the relevant statements in CONFIG.SYS and AUTOEXEC.BAT on both machines, but when that was done, all was well. I could share and transfer files and programs, examine schedules, and generally do networkish things, all in a very natural manner.

The bottom line is that if you connect the hardware properly, setting up a WFWG LAN really is as simple as adding the boards and running the software. I sure wish I'd done it that way.

Adding to the Network

My next step was to move the T connector with terminators from the 386/25 to my main machine, the Cheetah 486/33, putting a simple T connector on the 386/25; this



WE'VE JUST ADDED A NEW DIMENSION TO VT340 FUNCTIONS—WINDOWS.

KEAterm 340 gives the power of Windows to your host applications.

KEAterm products combine the features of Windows with the features of a VT terminal for true PC-to-host integration. Control your host data just as you control PC applications—with access to the same powerful software and printers. Host data becomes truly useable.

With KEAterm 340, you can use PC graphics tools to expand the use of host graphics. Copy ReGIS, Tektronix and sixel images into desktop publishing or draw packages for further manipulation.

Picture new power for host applications with KEAterm 340 for Windows.

- NEW FEATURES**
- ▶ Full VT340/420 Terminal emulation
 - ▶ ReGIS, Tektronix & sixel graphics
 - ▶ Multi-sessions
 - ▶ Multilingual menus
 - ▶ Copy & paste
 - ▶ DDE
 - ▶ File transfer
 - ▶ Network interfaces
 - ▶ Script language
 - ▶ On-screen buttons



KEA Systems Ltd.
Call 1-800-663-8702
Phone: (604) 431-0727
Fax: (604) 431-0818

KEA Systems Ltd. 3738 North Fraser Way, Unit 101, Burnaby, BC, Canada V5J 5G1
 KEAterm, KEAterm, ZSTEM, PowerStation, KEA and their respective logos are trademarks of KEA Systems Ltd. All other brand and product names are trademarks or registered trademarks of their respective holders.
 Copyright © KEA SYSTEMS LTD. 1992. All rights reserved.

From Your Friends In The Business...

Thank you for making 1992 the best year yet for everyone at Gateway 2000. Because of your belief in us, we captured an unprecedented five *Computer Shopper* 1992 Best Buy Awards including Best Overall Vendor.

And in *PC Computing's* 1992 MVP Awards, Gateway was honored with the MVP Desktop System Award for our 4DX2-66V system. Thank you *PC Computing*!

We're much obliged to *PC Magazine's* readers who gave us the best overall score in *PC Mag's* 1992 Service and Reliability Survey.

Our humble thanks to the readers of *PC World*. They honored us with two World Class Awards in 1992 – one for the Gateway 4DX-33 and another for Service and Support.

Our hats are off to *Compute* magazine for presenting us with 1992 Best Desktop Computer for the Gateway 4DX2-50.

We're thrilled that *Popular Science* magazine recognized the Gateway HandBook portable PC as one of 1992's "Best of What's New."

And thank you *BYTE* magazine for an Award of Distinction for the HandBook. *BYTE* readers also chose the Gateway 486DX as Desktop Computer of the Year.

Finally, we applaud all our loyal customers. Without your unwavering support throughout the years, Gateway couldn't have won these honors. We owe our success to you, and we'll be forever grateful. Here's to another great year in 1993!



SUNDAY 10-5

COMPUTERS

ALR Flyer 386/33 33 MHz
2 MB 1.44 F/D 60 MB \$799.00
486 DX 2/50 80 MB VGA \$1999.00

PACKARD BELL

286/12 1 MB 2 F/D
40 MB VGA Color \$599.99
386 SX/16 1 MB 2 F/D
84 MB VGA Color \$899.99

SCANNERS

HP ScanJet Plus \$799.99
HP ScanJet IIP \$1299.99
HP ScanJet IIC Color \$799.99
Microtek ScanMaker II \$1199.99
Microtek MSF600Z Color \$1199.99

MODEMS

Boca 14.4 Fax/Int \$259.99
Boca 14.4 Fax/Ext \$268.99
Supra 14.4 Fax/Ext \$295.99
U.S. Rob Dual Stnd \$714.99

NOTEBOOK COMPUTERS

TEXAS INSTRUMENT TM 4000
25 MHz 486 SX 120 HD \$2249.99
25 MHz 486 DX 120 HD \$2679.99
25 MHz 486 DX Color CALL

TOSHIBA

T-1800 SX/60 MB \$1249.99
T-1850 4/80 MB \$1594.99
T-1850 Color CALL
T-3300 SL/80 CALL
T-3300 SL/120 CALL
T-4400 C 80 Color \$3449.99
T-4400c 120 HD In Stock
T-6400 DX/200 In Stock

NEC

LASER PRINTERS

HP Desk Jet 500 \$369.99
HP Desk Jet 500 Color \$495.99
HP Desk Jet 550 Color \$689.99
HP Laser II P Plus \$799.99
HP Laser III P \$899.99
HP Laser 4 220 V \$1384.99
HP Laser 4 In Stock
HP Laser III Si \$2199.99
HP Paint Jet XL300 \$579.99
Panasonic KXP 4430 \$829.00
Panasonic KXP 4450 \$919.99
Panasonic KXP 400 \$949.99
Oki Laser 410 \$1359.99
Oki Laser 810 \$85.99
2 MB FHP Laser Jet \$99.99
2 MB Mem. I/O Kit \$119.99
2 MB Mem. I/Panasonic \$1299.00
(LW) WinPrinter 800 \$1299.00

PRINTERS

Canon BJ-10EX \$399.99
Canon BJ-200 \$259.99
Epson LQ-570 \$364.99
Epson LQ-1070 \$569.99
Epson LQ-1170 \$169.99
Epson LQ-810 \$419.99
Oki 320 \$209.99
Oki 380 \$419.99
Oki 590 \$859.99
Oki 595 Plus \$189.99
Panas. KXP 1180 \$259.99
Panas. KXP 1123 \$334.99
Panas. KXP 1624 \$159.99
Panas. KXP 2180 \$294.99
Panas. KXP 2124 \$294.99
Panas. KXP 2624 CALL

HARD DRIVES

80 MB IDE \$209.99
120 MB IDE \$269.99
213 MB IDE \$369.99
Plus HIC 105 XL \$299.99

MONITORS

NEC 3 FGX \$614.99
NEC 4 FG \$719.99
NEC 5FG \$1239.00
NEC 6FG \$2249.99

PALMTOPS/EXEC. ORGANIZERS

HP 95LX 512K \$369.99
HP 95LX 1 MB \$449.99
Casio SF R10 128K \$199.99
Casio SF R20 256K \$245.99
Casio SF 5300 64K \$66.99
Casio SF 8000 64K \$84.99
Casio SF 9300 64K \$139.99
Casio SF 9500 64K \$114.99
Casio SF 9700 64K \$149.99
Sharp IQ 8200 128K \$195.00
Sharp IQ 8400 256K \$269.99

FACSIMILE (FAX)

Brother Fax 600 \$419.99
Canon Fax 50 \$849.99
Canon B-70 Plain Paper \$899.00
HP Fax 200 Plain Paper \$489.00
HP Fax 310 Plain Paper \$899.00
Panafax UF 128 M \$364.99
Panafax UF 311 \$464.99
Pana. KXF-50 \$434.99
Quasar As KXF-90 \$434.99

IN USA & CANADA & P.R. INCLUDING NY STATE

1-800-874-1235

Fax: (212) 463-8335 (Include Voice & Fax #)

S & W COMPUTERS & ELECTRONICS

31 West 21 Street, New York, NY 10010

NYC (212) 463-8330

Mon.-Thurs. 9-6 Fri. 9-1:45
Saturday Closed

PRICES HARD TO MEET — SERVICE HARD TO BEAT! World Wide Inquiries Promptly Filled

DISCOVER • M.C. VISA, C.O.D. w/Deposit • No surcharge for credit cards. Shipp. addn. Handling 2% Qty. Ltd. Prices subject to change. Returns w/ written authorization. Free Parking Sunday. Meter Parking available. Prices for consumers.

USER'S COLUMN

gave me a daisy chain from the 486/33 to the 386/25 to the 486/25. Then I upgraded Windows 3.1 to WFWG and logged onto the network—and this time everything really did go as smoothly as all that, no problems whatever.

Flash: I've now seen the shipping version of the Microsoft WFWG Starter Kit. It includes instructions, a video, the cables and T-connectors and terminators, and even a screwdriver: about as complete and easy-to-use a kit as I have ever seen. If I'd had this, I wouldn't have had any problem at all.

Thin-Wire Blues

Since thin wire works so well and installs so easily (once you know how to terminate each end), why consider anything else?

The problem is that thin wire can be daisy chained only in a bus topology; and if any machine is disconnected from the network, whether deliberately or because of a bad cable, the whole network dies. Moreover, there's a long history of thin-wire cable problems, particularly if you make the cables yourself.

The alternative is twisted pair, which you'll remember has RJ-45 connectors that look like oversize telephone jacks and which connects with cables much like telephone cable. The advantage of twisted pair (otherwise known as Ethernet TP and officially as 10Base-T) is that you configure the system as a star (also known as *home run*): every cable goes to one central point, where they are all connected together. As long as any two machines are still connected to the network, you can transfer files between them. You can also have bridges from one star to another.

The disadvantage is that each star hub must have a *concentrator* into which all the 10Base-T lines run. The concentrator can be a stand-alone box or a board installed in a computer that you'll use as a network server; that board will also serve as the network card for the server machine. Concentrators can also accept thin wire as well as twisted pair. Concentrator costs vary, but they generally run around \$500 to \$1000, depending on the number of ports you need.

I'll have more on this another time. The goal here at Chaos Manor is to have twisted-pair lines run from nearly every room to a central concentrator box in the telephone closet. Note that a stand-alone concentrator need not be located near any computer at all: the network server is just another line into the concentrator if you use that scheme. Anyway, that's what we mean to end up with, and you'll get progress reports as I go.

continued

A MESSAGE TO OUR SUBSCRIBERS

FROM TIME TO TIME WE MAKE THE BYTE SUBSCRIBER LIST available to other companies who wish to send our subscribers material about their products. We take great care to screen these companies, choosing only those who are reputable, and whose products, services or information we feel would be of interest to you. Direct mail is an efficient medium for presenting the latest personal computer goods and services to our subscribers.

Many BYTE subscribers appreciate this controlled use of our mailing list, and look forward to finding information of interest to them in the mail. Used are our subscribers' names and addresses only (no other information we may have is ever given).

While we believe the distribution of this information is of benefit to our subscribers, we firmly respect the wishes of any subscriber who does not want to receive such promotional literature. Should you wish to restrict the use of your name, simply send your request to the following address.

BYTE

Magazine

Attn: Subscriber Service

P.O. Box 555, Hightstown, NJ 08520



The only Windows™ statistics package you'll ever need.

NEW
SYSTAT® for WINDOWS

#1 for DOS and Windows

Rated "the best general-purpose statistics program" for the PC by *Software Digest*®, SYSTAT for DOS is now joined by SYSTAT for Windows. This addition to the SYSTAT family takes full advantage of Windows, with pull down menus, dialog boxes, sizable windows, and the ease of use you expect in a Windows package.

SYSTAT for Windows runs in standard and 386 enhanced modes and can take advantage of Windows advanced memory management. No matter how large or complex your analysis is, you can use SYSTAT.

SYSTAT delivers a balance of power and simplicity. It lets you analyze and manipulate data

with a comprehensive range of advanced statistical procedures, and present your results with stunning graphics.

Just point and click

SYSTAT is a full-fledged Windows application. Just point and click. SYSTAT's QuickStat™ buttons give you simple, single-click shortcuts to common statistical analyses.

More statistics, from the basic to the most sophisticated

A full range of univariate and multivariate statistics—from *t* tests to multidimensional scaling. With a few clicks you can turn most statistics into graphs and perform:

- multiway crosstabs with log linear modeling
- nonparametric statistics
- principal components and factor analysis
- cluster analysis
- time series
- nonlinear estimation
- correlation matrices
- means, effect, and dummy models
- post hoc tests

SYSTAT offers the most advanced multivariate general linear model available for Windows.

The most graphics

No other statistical or graphics package can produce all the scientific and technical graphs that SYSTAT can—nor surpass its ease of use. Graphics capabilities include:

- histograms
- single, multiple, stacked, and range bar graphs
- single and grouped box plots
- stem-and-leaf diagrams
- pie charts
- scatterplot matrices
- 3-D data and function plots
- contour plots
- control charts
- maps with geographic projections
- Chernoff faces
- complete color spectrum
- log and power scales
- confidence intervals and ellipses
- linear, quadratic, step, spline, polynomial, LOWESS, exponential, and log smoothing

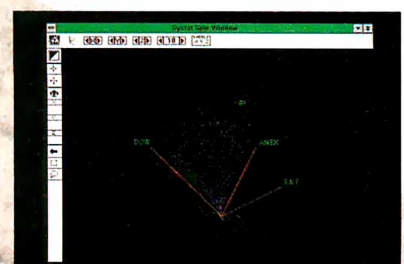
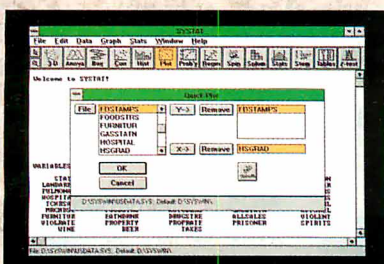
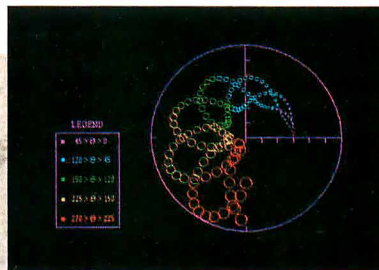
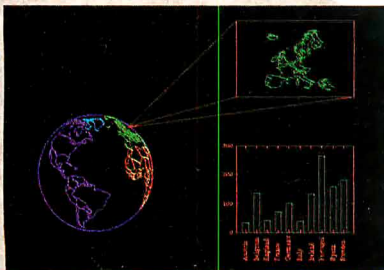
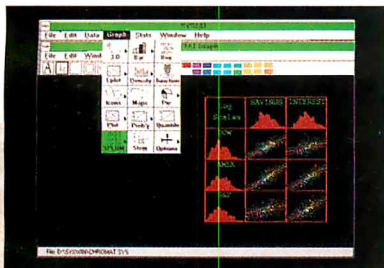
A compatible family of products

Whichever you choose—SYSTAT for Windows, SYSTAT for DOS or both—you'll enjoy the most powerful statistics and scientific graphics software available for the PC.

For more information, special offers for current users, and demo disks, call:

708-864-5670

For Windows circle 138,
For IBM/DOS circle 139.



SYSTAT

For more information call or write: SYSTAT, Inc., 1800 Sherman Avenue, Evanston, Illinois 60201-3793. Tel: 708.864.5670, Fax: 708.492.3567

Australia: Hearne Marketing 61.3.8661766, BeNeLux Countries: Oasis 31.3402.66336, Denmark: Agrolab 45.64.406575, France: Deltasoft 33.76.418508, Germany: STATCON 49.55.4272075, Italy: PiSoft 39.587.213640, Japan: HuLinks 81.33.5902311, Malaysia: Dagang Teknik 6.03.719.8299, New Zealand: Hoare & Assoc. 64.78.562675, Spain: AddLink 34.3.4590722, Switzerland: Fritschy & Partner 41.31.215151, SYSTAT UK: 44.81.4620093

© 1992 SYSTAT®, Inc. Software Digest Ratings Report 8.5, May, 1991. Software Digest is a registered trademark of NSTL, Inc.

The LANtastic Alternative

One alternative to WFWG is Artisoft's LANtastic for Windows. I'll be comparing WFWG and LANtastic in the next few columns. Each has strong points.

Whether you use LANtastic or WFWG, you should strongly consider getting cards that have both thin-wire and 10Base-T interfaces. LANtastic's boards have all three: thin wire, twisted pair, and the DB-15 thick wire (which few places use now). Thin wire is easily set up, and you can lay the lines on the floor for testing the system. Once you know where you want lines, it's cheaper to have 10Base-T cable pulled through the walls. As your LAN grows, you'll find that cabling costs aren't trivial.

Finally, if you connect up your WFWG with LANtastic boards, you can set up software controls to run your system with WFWG, LANtastic for DOS, and LANtastic for Windows. (You cannot run LANtastic and WFWG simultaneously; it's one or the other, but never both.) For that matter, you can install just about any network software known, including full-blown NetWare 3.x, with LANtastic cards.

That kind of flexibility is worth having. However, fair warning: installing LAN-

tastic boards is not as simple as installing the Intel EtherExpress 16. There are jumpers to select I/O addressing, IRQs (interrupt requests), and other such matters. The manuals, while complete, tend to assume knowledge of things you may not know. While Softset goes out and looks at what's happening in your system, chooses the proper settings, and configures the board, all in software, LANtastic boards require you to use some program like WinSleuth or Checkit to be sure there are no addressing and IRQ conflicts. (Another way is to cheat: install an Intel board, run Softset, write down the settings Softset recommends for the Intel board, and set the LANtastic board up that way.)

In a word: setting up with LANtastic boards will give you a considerably more flexible system, but you'll have more trouble getting it running. Clearly, it's not *that* much trouble: Artisoft is now one of the largest suppliers of Ethernet boards in the country.

Finally, if you do get the Microsoft/Intel Starter Kit and go with thin wire, you haven't locked yourself out of using LANtastic later on; LANtastic will run with the Intel boards.

And that's enough on networks for this month. More next time; indeed, networking will be a major theme all year.

Hypertext Help

There's no excuse for releasing Windows products without adequate help files. By adequate, I mean well indexed, with index entries for the operations your customers will want to perform and with live cross-references, otherwise known as hypertext. If you include a glossary (and in most cases you should), that ought to be linked in so that you can get pop-up definitions of terms from inside the help screen rather than have to go look things up.

All that and more can be done by using Doc-to-Help from WexTech Systems. Doc-to-Help requires Word for Windows 2.0 (and Windows 3.x itself, of course). What you get is a system for converting Word for Windows documents into indexed hypertext documents, using those to build help files and compiling the help files so they'll work in Windows. The package includes the Microsoft Help Compiler, but fortunately you don't need to know much about how that works.

The indexing capability is limited and a

DATA COMPRESSION LIBRARIES™

PKWARE's® Data Compression Libraries™ allow software developers to add data compression technology to software applications. The application program controls all the input and output of data allowing data to be compressed or extracted to or from any device or area of memory.

- All Purpose Data Compression Algorithm Compresses Ascii or Binary Data Quickly with similar compression achieved by the popular **PKZIP** software, however the format used by the compression routine is completely generic and not specific to the PKZIP file format.
- Application Controlled I/O and memory allocation for extreme flexibility.
- Adjustable Dictionary Size allows software to be fine tuned for Maximum Size or Speed.
- Approximately 35K memory needed for Compression, 12K memory needed for Extraction.
- Compatible with most popular Languages: C, C++, Pascal, Assembly, Basic, Clipper, Etc.
- Works with any 80x86 family CPU in real or protected mode. \$295.00
- No runtime royalties.

RUNNING OUT OF EXPENSIVE DISK SPACE?

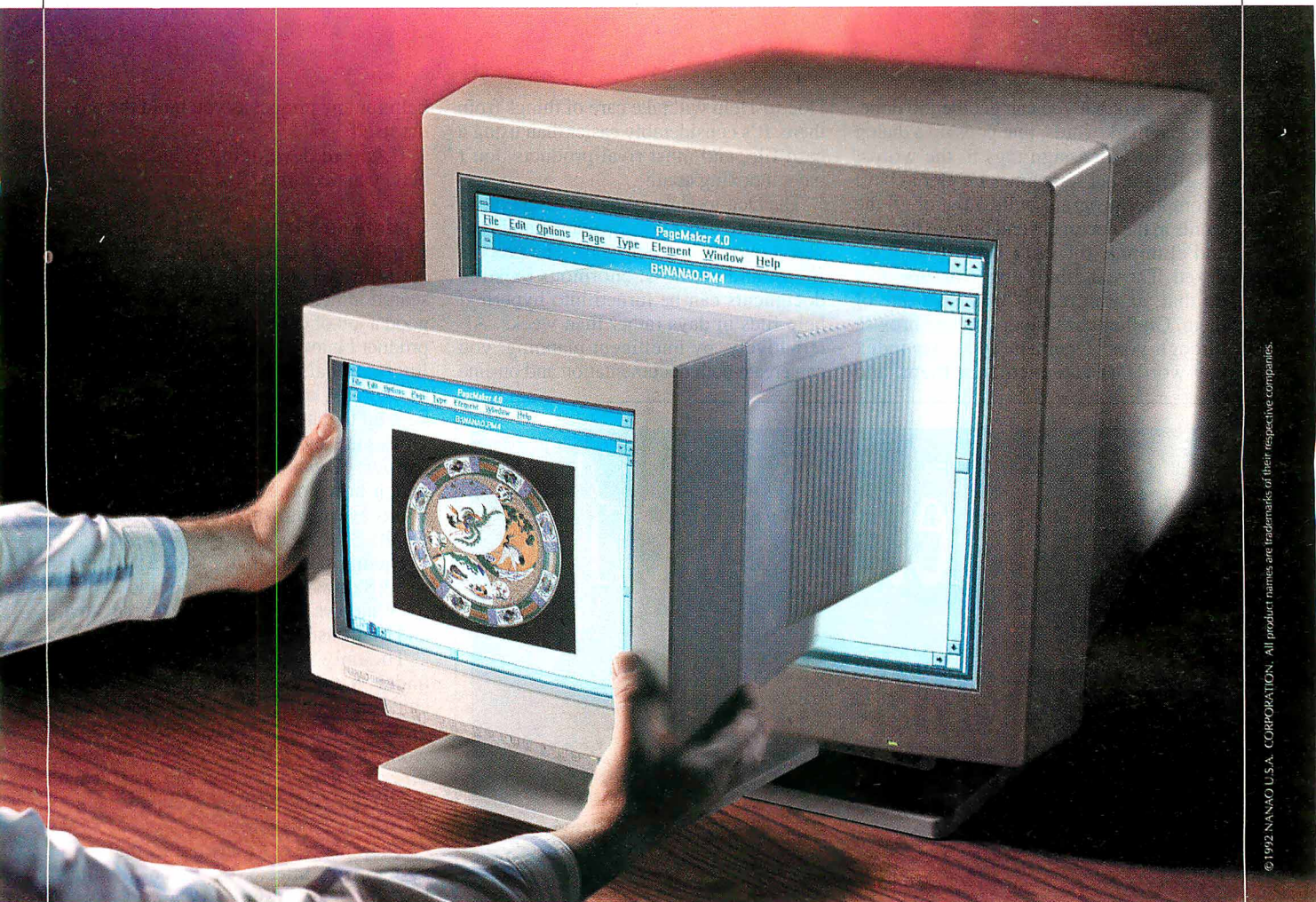
PKZIP can help! **PKZIP** compresses your files to free up disk space and reduce modem transfer time. You can compress a single file or entire directory structures with a single command. Compressed files can be quickly returned to their normal size with **PKUNZIP**.

Software developers can reduce the number of diskettes needed to distribute their product by using **PKZIP**. Call for Distribution License information.

The included **PKZIP** utility lets you store compressed files as a single self-extracting .EXE files that automatically uncompresses when run. Only \$47.00



9025 N. Deerwood Dr.
Brown Deer, WI 53223
(414) 354-8699
Fax (414) 354-8559
BY293



© 1992 NANA O U.S.A. CORPORATION. All product names are trademarks of their respective companies.

PRESENTING A NEW GENERATION OF SUPERIORITY.

The Nanao FlexScan® family of award-winning big-screen monitors introduces our newest family member. The FlexScan F340iW – an affordable monitor for Windows applications.

Our new 35lb., 15" addition has the same traits as its big brothers. Features like our exclusive Advanced Image Control System that lets you adjust color balance, store picture adjustments and recall the settings...automatically. And a flat-square, .28mm dot pitch Invar Shadow Mask CRT combined with Dynamic



Finalist
FlexScan F340iW

Beam Spot Control to optimize both resolution and convergence over the entire screen. You get a brilliant, sharp image and 20% more work area than a 14" monitor, plus 1024 x 768 resolution at a 76Hz flicker-free refresh rate, up-front controls and compliance to MPR-II guidelines – all of which make the F340iW a healthy addition to any work environment.

So, if you're looking for a quality monitor for Windows applications, but a 17" is beyond your budget, you've found it.

Congratulations.

NANA O®

Superior in every detail.™

NANA O U.S.A. CORPORATION

23535 Telo Avenue, Torrance, CA 90505
(310) 325-5202

1-800-800-5202

Circle 105 on Inquiry Card (RESELLERS: 106).

bit awkward, but you can get the job done. You can mark words; that pops up a dialog box to let you assign tags to the words. It's all right, but sometimes I prefer to have a computer program build a list of all the words in the document and then go through and eliminate the ones I don't want indexed. There are indexing programs that do that, and more, but this isn't one of them. On the other hand, you can browse through your document and enter index key words as you encounter them, and

Doc-to-Help will take care of things from there. It's considerably easier than using a card file, and most rival products don't have indexing at all.

The Doc-to-Help system is essentially a way to take paper documentation and convert it into on-line help files. The process is fast and painless: enormous existing documents can be turned into hypertext help files in days rather than weeks. Alternatively, by intelligent planning, you can create both documentation and on-line

help for any project as you build the product itself.

If you're developing Windows products, you need this. Recommended.

Update on Viruses

I continue to recommend Dr. Solomon's Anti-Virus Toolkit for DOS. All my research indicates that the software does as good a job of detecting virus threats as any product I know, and furthermore, the S&S International staff vigorously seeks out new viruses and disassembles them, so it's kept up to date. The explanations of what viruses are and what they do are excellent; and *Dr. Solomon's Virus Encyclopedia*, which now comes with the Toolkit, explains every known virus in considerable detail.

Having said all that, I have a warning.

S&S now sells a version of the Toolkit for Windows. Don't buy it, don't rely on it, and don't use it.

The only way you can run a program under Windows is to boot up your machine and then run Windows. That gives a virus a chance to go memory resident. I won't go into details, but a well-written virus, once memory resident, can evade just about every virus-detection scheme. Most won't, but some can.

The only way to be certain that your system isn't infected is to boot it with a known clean floppy disk and then run (preferably from a write-protected floppy disk) a good virus-detection program, like S&S's Toolkit for DOS. This is the advice Dr. Solomon and S&S International have always given, and good advice it is, too. Incidentally, the Toolkit for DOS comes with the Toolkit for Windows, which is just fine, but why pay for the Windows version in the first place?

Death Threat

I would like to perform a public service: I want to kill the mechanical engineer who designed the board system for the IBM PC bus—the one who put the little tabs on the bottom ends of the board mounts. For my own personal satisfaction, I would like to use something lingering with boiling oil, but the public service would be to see that this engineer doesn't work on anything else.

The system is unbelievably dumb; it's as if it were designed for computers that will never have boards changed and will not be moved around. Boards get loose. You can't get the screws in. If you try to change a couple of boards, you can tear half the flesh off your fingers and the backs of your hands.

For those who are going completely nuts installing boards, I have a tip: get a pair

New SmarTerm for Windows clearly puts more VT text and graphics emulation power and ease at your fingertips. Corporate support features include a toolbox, button palettes, trace and remapping utilities, scripting, keyboard mapping, and customizable-help. SmarTerm 340 for Windows provides outstanding ReGIS, Tektronix, and sixel graphics capabilities. SmarTerm, connecting users worldwide, is also available for VT320 and VT340 emulation using DOS.

Persoft, Inc. 465 Science Dr. P.O. Box 44953
Madison, WI 53744-4953
Call toll-free 1-800-EMULATE Fax (608) 273-8227
European Headquarters World Trade Ctr. Beursplein 37
Box 30237 3001 DE Rotterdam The Netherlands
Phone +31 10 405.3560 Fax +31 10 405.5073



©1992, Persoft, Inc. All Rights Reserved.

Persoft and SmarTerm are registered trademarks of Persoft, Inc. All other trademarks mentioned are properties of their respective owners. Rev. 11/92

BEFORE PROTECTING YOUR SOFTWARE...

NEW!
TimeHASP®
Protect Your Software
Keep the Time

...against piracy and unauthorized use, make sure that your protection system has all the following qualities:

A GOOD HARDWARE KEY

Hardware-based software protection systems are now the standard worldwide. However, not all keys are the same. A good key should have all the following features:

✓ Compatibility and transparency. The key should work without any problem on your customers' computers. The user should be able to forget the key after connecting it.



✓ Unbreakable electronics. A customized ASIC (Application Specific Integrated Circuit) component should be integrated in the key. This prevents reverse engineering and makes cracking virtually impossible.



✓ A unique and inaccessible software developer's code burnt into the ASIC. (This code should not be held in the key's memory, where it can be read and altered.)

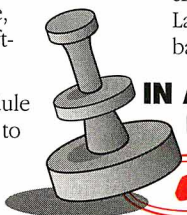
✓ A Read/Write Memory inside the key should be available on demand. The memory should be writable in the field, on any PC, without any special programming equipment.

✓ Very low power consumption, enabling the key to work even under the worst power conditions, on PCs and laptops, with or without a printer.

POWERFUL SOFTWARE

Since it's practically impossible to crack or duplicate a key having all the features mentioned above, a pirate will usually go for the software linking the protected program to the key. Therefore, check that your protection software has all of the following:

✓ A Linkable Protection Module with which calls can be made to the key from any point in the protected program.



✓ An "Envelope" installation program. Such programs enhance security while making it possible to protect a software even without its source code.

✓ Sophisticated antidebugging and encryption mechanisms.

HASP®, THE PROFESSIONAL SOFTWARE PROTECTION SYSTEM, OFFERS YOU ALL THESE FEATURES AND MORE:

HASP was designed by a team of computer experts, professional cryptologists, and electrical engineers. As a result, HASP keys are supported by what is probably the best software in the market, and the HASP system has worked on every computer it has been tried on. In addition to all the features mentioned above, HASP provides:

✓ A Full Authorization

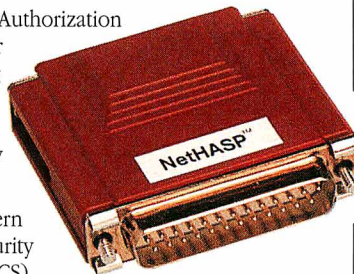
System for protecting dozens of programs using only one key.

✓ A Pattern Code Security System (PCS)

enabling parallel processing of multiple calls by the Linkable Protection Module.

✓ A Virus Detection option that can be incorporated in the protected program to check whether it has been infected by a virus or tampered with in any way.

✓ Several HASP keys can be daisy-chained.



NETHASP, SOFTWARE PROTECTION FOR NETWORKS

✓ Only one NetHASP key is needed to run a protected program from many stations in a network. NetHASP provides full support for protecting DOS and WINDOWS software under network environments, including Novell dedicated & non-dedicated servers, Lan Manager, Lantastic, Banyan, DLink, and NET-BIOS based LANs.

IN A TEST CARRIED OUT BY AN INDEPENDENT LAB, HASP WAS THE ONLY KEY WHICH WAS NOT BROKEN*.

OPERATING ENVIRONMENTS

✓ **PC:** DOS, WINDOWS, OS/2, SCO UNIX, SCO XENIX, INTERACTIVE UNIX, AIX, AUTOCAD, DOS EXTENDERS

✓ **MAC (ADB Port):** System 6.0.5 and up

✓ **NEC (Serial Port):** DOS, WINDOWS

AND THE BOTTOM LINE:

We offer some of the most competitive prices in the market.

Since 1984, HASP has enabled thousands of software producers in more than 40 countries, including several Fortune 500 companies, to protect their software.

To learn more about why so many professionals have chosen HASP, call us for our low price evaluation package.



North America:

200 Broadhollow Rd., Suite #207
Melville, NY 11747, USA
Tel: 800-223 4277
516-424 5100
Fax: 516-424 8300

International Office:

ALADDIN KNOWLEDGE SYSTEMS LTD.
15 Beit Oved St., Tel-Aviv, Israel
P.O.Box:11141 Tel-Aviv 61110,
Tel: 972-3-5375795
Fax: 972-3-5375796

- **Australia** Conlab Pty. Ltd., Tel: 3 8985685
- **Belgium** Akkermans bvba, Tel: 3 2338826
- **CSFR** ATLAS Ltd., Tel+Fax: 2 766085
- **Chile** Micrologica S.A., Tel: 562 222 1388
- **Denmark** SC Metric a/s, Tel: 42 804200
- **France** Logidata Intl., Tel: 50707375
- **Germany** CSS GmbH, Tel: 201 749860
- **Greece** Unibrain SA, Tel: 1 6856320
- **Holland** Akkermans BV, Tel: 45 241444
- **Italy** Partner Data S.r.l., Tel: 2 33101709
- **Korea** Dae-A Engineering, Tel: 2 848 4481
- **New Zealand** Training Solutions, Tel: 4 5666014
- **Poland** Systherm Tel: 061 45065
- **Portugal** Futurmatia Lda., Tel: 1 4116269
- **South Africa** D Le Roux, Tel: 11 886 4704
- **Spain** PC Hardware, Tel: 3 4493193
- **Switzerland** Opag AG, Tel: 61 7112245
- **Taiwan** Teco Ltd., Tel: 2-555 9676
- **Turkey** Mikrobeta Ltd., Tel: 4-4677504

* CT Magazine, May 1990.

© Aladdin Knowledge Systems Ltd. 1985-1992

Design: Ian Peet

This is the BIG one!

Big screen. Will travel.



Introducing new ScreenStar™ from BitWise, the world's first portable with dual-page display. It's a 486 50MHz PC workstation constructed within a suitcase for unrivaled performance in a portable package.



DUAL-PAGE ScreenStar's massive 21.3" gas plasma screen folds flat within the suitcase, and easily displays two 8-1/2" x 11" documents at full size, to powerfully present data in meetings, in the field, or on the road.

5-1/4" bay for optical/CD drive
1280 x 1024 resolution
3 full-length slots
Up to 32 MB RAM
Up to 1 GB hard drive



Imagine the possibilities. Impressively present to large groups. Effortlessly run the most demanding software. Effectively travel with a powerful document imaging system.

Portable computing without compromise. Discover the quality and innovation of ScreenStar. Otherwise, it's not a BitWise.



800-367-5906
BitWise Designs, Inc.
Technology Center
Rotterdam Industrial Park
Schenectady, N.Y. 12306

COMPUTERS WITHOUT COMPROMISE™

USER'S COLUMN

of big, heavy metal-cutting nippers—and cut the stupid little tongue off.

LaserMaster

A quick note about LaserMaster. The National Association of Theater Owners has adopted the LaserMaster WinJet, Aldus PageMaker, and Windows to do all their publications, including the program for their yearly convention.

I have reported on the WinJet before: it installs in your Hewlett-Packard LaserJet III and connects to another board in your Windows computer. The result is that it does the raster-image processing in your computer and squirts that to the printer, making the whole process incredibly fast compared to what PageMaker normally does. For single-user desktop layouts and publications, it's hard to beat. Alex installed the system some time ago and says the only calls he gets from that customer are to tell him how terrific it is.

The Mail Dilemma

I like MCI Mail. It's not as elegant as AT&T's E-mail service, but it has been around a long time, a lot of people I want to talk to are on it, and I'm used to it. Every now and then, there's a glitch. The most common one used to be that some new PR firm would get on, discover just how many columnists and editors and freelance writers are on MCI, and build up an enormous mailing list to which they'd send new product announcements. Unfortunately, they wouldn't study the manual on how to handle mail lists, and the result would be that it would take 10 minutes to download the header and "To:" list before the message came in. The first time that happened, I thought it was amusing, and besides, I got a good mail list out of it. The next dozen times weren't so funny.

The main reason I use MCI Mail, though, is that Norton Commander has a built-in front end for it. Set Commander up properly, and you can tell it to go get your MCI Mail. You can then read that mail and reply to it off-line. The next time Commander goes forth to MCI—either because you sent it manually or because you set it to do it automatically—it will first send out all your replies and other messages. This can all happen invisibly in the night or in the background while you work on something else. Lotus Express uses the same method to achieve the same result.

Alas, the past few weeks when I sent Commander after MCI Mail, it failed as often as not. Sometimes it would get "ring no answer," which is understandable at busy times; but often I'd get an answer, the system would appear to lock on at 2400

STATISTICA/w

Windows
DOS, Macintosh

STATISTICA/w™ (for Windows) Complete Statistical System with thousands of on-screen customizable, presentation-quality graphs fully integrated with all procedures ■ Complete Windows 3.1 support, DDE, OLE, TT-fonts, multiple toolbars, right mouse button support ■ Unlimited numbers of data-, results-, and graph-windows ■ Inter-window integration: data, results, and graphs can be treated as objects and converted into one another in a number of ways ■ The largest selection of statistics and graphs in a single system; comprehensive implementations of: Exploratory techniques; multi-way tables with banners (presentation-quality reports); nonparametrics; distribution fitting; multiple regression; general nonlinear estimation; stepwise logit/probit; general ANCOVA/MANCOVA; stepwise discriminant analysis; log-linear analysis; factor analysis; cluster analysis; multidimensional scaling; canonical correlation; item analysis/reliability; survival analysis; time series modeling; forecasting; lags analysis; quality control; process analysis; experimental design (with Taguchi); and much more ■ Manuals with comprehensive introductions to each procedure and examples ■ Hypertext-based Stats Advisor expert system ■ Extensive data management facilities (spreadsheet with long formulas, block operations, advanced Clipboard support, DDE hot links, relational merge, data verification, powerful programming language) ■ Batch command language and macros also supported, "turn-key system" options ■ All output displayed in Scrollsheets™ (dynamic, customizable, presentation-quality tables with toolbars, pop-up windows, and instant 2D, 3D and multiple graphs) ■ Extremely large analysis designs (e.g., correlation matrices up to 32,000x32,000, unlimited ANOVA designs) ■ Megafile Manager with up to 32,000 variables (8 Mb) per record ■ Unlimited size of files; extended ("quadruple") precision; unmatched speed ■ Exchanges data and graphs with other applications via DDE or an extensive selection of file import/export facilities ■ Hundreds of types of graphs, including categorized multiple 2D and 3D graphs, matrix plots, icons, and unique multivariate (e.g., 4D) graphs ■ Facilities to custom design new graphs and add them permanently to menu ■ On-screen graph customization with advanced drawing tools, interactive stretching and resizing of complex objects, interactive embedding of graphs and artwork, special effects, icons, maps, multi-graphics management, page layout control for slides and printouts; unmatched speed of graph redraw ■ Interactive rotation, perspective and cross-sections of all 3D and 4D graphs ■ Extensive selection of tools for graphical exploration of data: fitting, smoothing, overlaying, spectral planes, projections, layered compressions, marked subsets ■ Price \$995.

Quick STATISTICA/w™ (for Windows) A comprehensive selection of basic statistics and the full graphics capabilities of STATISTICA/w ■ Price \$495.

STATISTICA/dos™ (for DOS) A STATISTICA/w-compatible data analysis system ■ Price \$795.

Quick STATISTICA/dos™ (for DOS) A subset of STATISTICA/dos statistics and graphics ■ Price \$295.

Domestic sh/h \$10 per product; 14-day money back guarantee.

Circle 134 on Inquiry Card.

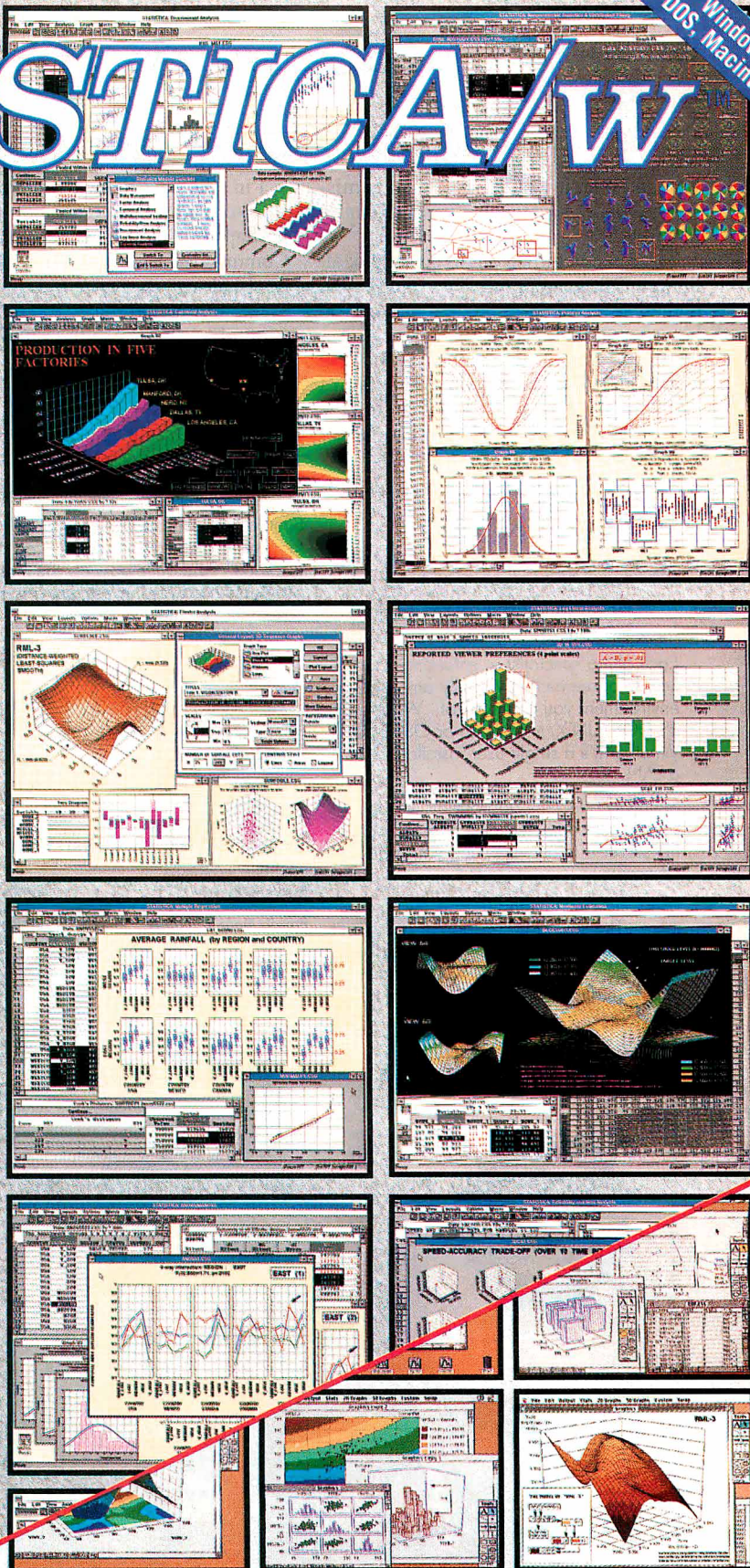


StatSoft™

2325 E. 13th St. • Tulsa, OK 74104 • (918) 583-4149
Fax: (918) 583-4376

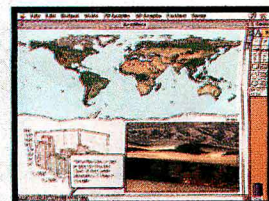
Overseas Offices: Statsoft of Europe (Hamburg, FRG), ph: 040/4200347, fax: 040/4911310; StatSoft UK (London, UK), ph: 0462/482822, fax: 0462/482855; StatSoft Pacific (Melbourne, Australia), ph: (03) 663 6580, fax: (03) 663 6117; StatSoft Canada-CCO (Ontario), ph: 416-849-0737, fax: 416-849-0918. Available From: CORPORATE SOFTWARE and other Authorized Representatives Worldwide: Holland: MAB Julsing, 071-230410; France: Version US (1) 40590913; Sweden: AkademiData 018-240035; Hungary: Dagent Kft 186-5782; Belgium: TEXMA 10 61 16 28; South Africa: Osiris 12 663-4500; Japan (Macintosh): Three's Company, Inc., 03-3770-7600; Japan (DOS and Windows): Design Technologies, Inc., 03-3667-1110.

StatSoft, STATISTICA/w, Quick STATISTICA/w, STATISTICA/Mac, Quick STATISTICA/Mac, STATISTICA/DOS, Quick STATISTICA/DOS, and Scrollsheet are trademarks of StatSoft, Inc.



STATISTICA/Mac™ (for Macintosh) A STATISTICA/w-compatible, comprehensive data analysis and graphics system designed for the Macintosh ■ Large selection of statistical methods fully integrated with presentation-quality graphics (incl. EDA, multiplots, a wide selection of interactively rotatable 3D graphs; MacDraw-style tools) ■ Unlimited size of files ■ Full support for System 7, incl. "Publish and Subscribe" ■ Price \$595.

Quick STATISTICA/Mac™ (for Macintosh) A subset of STATISTICA/Mac: a comprehensive selection of basic statistics and the full graphics capabilities of STATISTICA/Mac ■ Price \$295.



bps, and then it would never gain admission to MCI. Once that happened 50 times in a row.

The remedy turned out to be simple: although Commander tells you to enter the highest speed for your modem (up to 9600 bps), you shouldn't do that. Instead, set 2400 bps, which is the highest speed I've ever seen it lock on anyway. That won't end "ring no answer," but it does stop the nonsense of not being able to handshake with the MCI Mail modems.

I'm told that MCI will bring out its own front-end program Real Soon Now, and perhaps that will be superior to Norton Commander. Until then, I have Commander Mail with its own Windows PIF (program information file), 2500 ticks in foreground and background, and it's good enough.

SuperCard

Roberta is jazzing up her reading program and transferring it to other systems. Part

of that is being done by Chris Innanen, who's converting it into SuperCard for the Mac. SuperCard is, unsurprisingly, a superset of the HyperCard programming toolkit for the Mac. Actually, it's quite a lot more than that. They don't call SuperCard a multimedia programming language because that might frighten off potential customers; but in fact, SuperCard is powerful enough to create commercial-quality stand-alone programs while remaining easy to use.

I have said for years that the real goal of the computer revolution is to get ordinary users developing computer applications. SuperCard and Apple's Mac together are a giant step in that direction. With SuperCard you can build simple programs employing sound and graphics to achieve complex results. You can also build very complicated programs: Supercard contains most of the BASIC control structures, such as IF...THEN, DO WHILE, DO UNTIL, and FOR...NEXT (the last three are found under the REPEAT command).

SuperCard contains SuperTalk, animation tools, and suchlike. It has a debugger (called a run-time editor). It creates objects; and of course it integrates all this rather seamlessly into the Mac Desktop environment. Roberta, who has no interest in programming except as a means of getting her education programs running, is quite thrilled with SuperCard's capabilities. You may also want Aldus SuperPaint, which makes drawing with SuperCard a bit easier.

Both SuperPaint and SuperCard were developed by an outfit known as Silicon Beach, before it was bought out by Aldus. I keep hearing hints of a new-and-improved SuperCard, but don't let that stop you from getting it now. Aldus has always had reasonable upgrade policies.

If you're a Mac user thinking about developing programs but afraid that will be too hard, get SuperCard. It's a great introduction to how to make your machine do things for you. Recommended.

PowerBook Note

If you use LapLink Mac with a PowerBook and it just won't link up, open the Control Panel, open the Portable icon, and click on external modem. Like a lot of Apple interface commands, this is obvious once thought of, but it's not precisely intuitive.

PowerBooks are showing up all over the place now. Older ones are offered at astoundingly low prices, low enough that we've thought wistfully of bundling Roberta's reading program in with one as a stand-alone learn-to-read kit. We won't do that, but I wish someone would. *continued*

PUT AN END TO SOFTWARE PIRACY!

Meet the growing family of security keys from Software Security.

Each one a specialist at enforcing your license agreement in virtually any user environment you can think of. Whether it's DOS, UNIX, Macintosh or OS/2. Whether it's a single user installation or a LAN.

Simply connect the appropriate key to a single user computer, or a non-dedicated file server in a network, and you control all access to your protected application.

Users, however, won't even know it's there. The keys are transparent and won't impact software functionality or the ability to make back-up copies. Normal node and LAN operations are unaffected.

The Ultimate Protection For Software Publishers

NOW AVAILABLE! NETWORK PROTECTION WITH REMOTE UPDATING!

Simple. Unassuming. Ever vigilant. Easy to incorporate into your application package. And quite possibly the most profitable hardware investment a software developer can make.

To find out more, call:

1-800-841-1316

IN CONNECTICUT CALL: 203-329-8870

FAX 203-329-7428

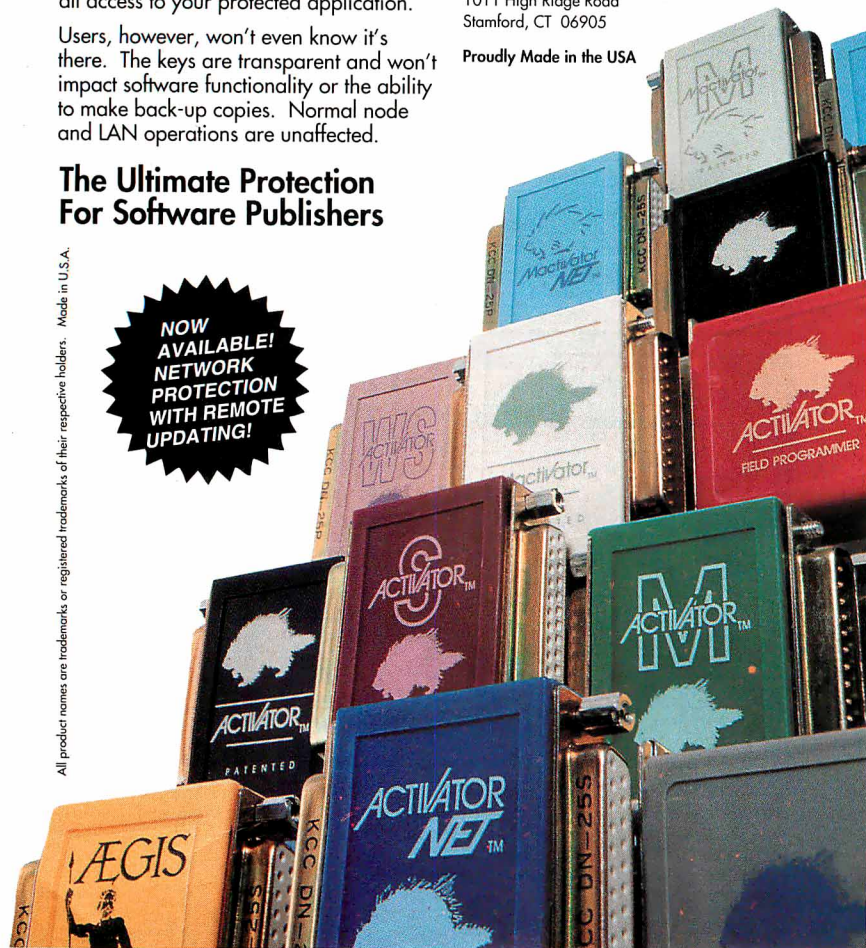
EUROPE AND UK: + 44 784 43 00 60



SOFTWARE SECURITY INC.

1011 High Ridge Road
Stamford, CT 06905

Proudly Made in the USA



North American Readers circle 198; Other Readers Worldwide circle 199.

All product names are trademarks or registered trademarks of their respective holders. Made in U.S.A.

The World's Best Selling UNIX Clone Just Got Better.

Now with full 32-bit implementation!

If you want to ignite your 32-bit hardware with the multi-user, multi-tasking power of UNIX, Coherent 4.0 has arrived. And if you're operating or selling small business network systems with dozens of users, that's really good news. Because Coherent 4.0 is what you want in UNIX at a price that's hard to believe.

Run UNIX applications today!

Coherent is now binary compatible with UNIX. Most UNIX PC applications port with a simple recompile and many now run right out of the box. The list is growing everyday, so call for details.

Yes, It's For Real!

How can it be? First of all, Coherent was independently developed by the Mark Williams Company, so you don't pay for UNIX licensing fees. You don't pay any mark-up or reseller costs either. Coherent is only sold directly to you.

*"... (Coherent) may be the best thing that has happened to UNIX yet."
—William Zachmann, PC Week*

In fact, over 40,000 copies of Coherent have already been sold. And, like the ones we quote here, virtually every critic who's reviewed Coherent has raved about it.

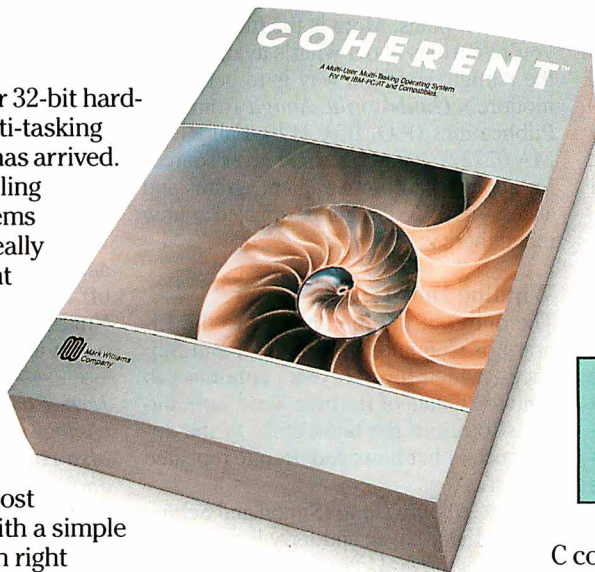
So Much Less, Yet So Much More.

As a virtual clone of UNIX, Coherent embraces the original UNIX philosophy: Small is beautiful. Small price, yes. But there's more, much more, to Coherent than its amazing price.

Requiring only 10 megabytes of disk space, Coherent can reside with DOS. So you can keep all your DOS applications and move up to Coherent. And it runs with as little as 1 MB of memory versus 4 MB for other UNIX versions.

The World's Only Plug And Play UNIX Clone.

You'll have Coherent up and running with a fraction of the time and effort it takes for other UNIX versions. Our



six disk installation is a breeze compared to their 25. You'll also learn it faster and increase overall performance. All because Coherent is smaller, faster... and better.

Small, But So Complete.

Make no mistake, Coherent is a wholly professional development system. You get a complete

"Coherent comes so fully qualified as a UNIX clone, you find yourself thinking, 'I can't believe it's not UNIX.'"—Sean Fulton, UNIX Today!

Coherent.TM Still \$99.95.

C compiler, assembler and over 200 UNIX commands including full sets of functions for development, administration, maintenance and text processing.

Coherent also comes with UUCP capabilities that connect you to a world-wide network of free software, news and millions of UNIX users. And it's all clearly documented in Coherent's highly praised 1200 page manual.

Experienced, Supported, Guaranteed.

Mark Williams Company has been developing professional programming tools since 1976. Our commitment to our products and users is unsurpassed. Users applaud our popular BBS and the widely acclaimed telephone support they get free from Coherent developers.

Still, we're not asking you to take a chance on Coherent. We've made it fool-proof to see for yourself—with a 60-day money-back, no hassles guarantee. So pick up that phone and order Coherent now. And the best way to UNIX will be on its way to you!

800-MARK WMS

(800-627-5967 or 708-291-6700, FAX: 708-291-6750)

60-DAY MONEY BACK GUARANTEE!



Mark Williams Company

60 Revere Drive, Northbrook, IL 60062

Coherent is a trademark of Mark Williams Company. UNIX is a trademark of USL.

	MWC COHERENT Version 4.0	SCO UNIX/386 Version 3.2V2
No. of Manuals	1	14
No. of Disks	6	25
Kernel Size	100 K	375 K
Install Time	40 min.	3-4 hours
Suggested Disk Space	10 meg	60 meg
Min. Memory Required	1 meg	2-4 meg
Performance*	85.7	31.3
Price	\$99.95	\$2590

*Byte C Compiler Benchmark: Compiles per minute on 25 MHz 486.

Quotemaster Plus

Instructions on installing this for Windows aren't clear, but otherwise it's not a bad program. The quote list is different from *Bartlett's Familiar Quotations*, which may be all to the good. It's easy to use, and there are other subject quote lists available that use the same search engine.

It's a reasonable tool for spicing up a speech or essay, and I found a couple of quotes to use as aphorisms at chapter breaks. It's worth having a look at if you deal in words.

Programmer's Tool

Alloc-GC is a garbage-collecting replacement for the allocation functions that come with C compilers. Programs that use it don't need to explicitly deallocate memory, because unreferenced blocks are reclaimed and reused when memory runs low. C++, like C, uses explicit deallocation; garbage collection is used in Smalltalk, Lisp, and suchlike.

I make you aware of it. I don't like C++ much better than I like C, but if you use C++, you might try this; it's said to simplify the code and eliminate some of the bugs caused by having to write destructors and deallocations.

They're Back

Amiga and Commodore America have come back in a big way: new machines, great new plans. More in the future, but if you're curious about what's available for the Amiga, a simple way is to get Commodore's *Guide to the Amiga* from Pim Publications (P.O. Box 2140, Fall River, MA 02722). It describes and gives sources for about 10 zillion Amiga programs and accessories. You might be amazed at how much there is.

Winding Down

The onion of the month goes to the Library of Computer Information and Sciences, which for two years continues to send to "Estate of Barbara Yost" solicitations to rejoin the book club, to the annoyance of her heirs and despite repeated protests.

The Gripping Hand (Simon and Schuster), by Larry Niven and Jerry Pournelle, is the sequel to *The Mote in God's Eye*, and it should be available in bookstores about the time you read this. We wrote *Mote* in 1972, and I'm pleased to say that we haven't had to do much updating of the computer capabilities we built into that book.

Books of the month: Kris Jamsa's *Con-*

cise Guide to Windows For Workgroups (Microsoft Press, 1992). It's a quick introduction to WFWG features. If you're at all interested in writing for the audiovisual field, a good introduction is the new edition of Dwight and Joye Swain's *Scripting for the New AV Technologies* (Focal Press, 1992).

Next month: Space Adventure from Knowledge Adventure (you'll love it); a lot more about networks and networking; and, with luck, just a lot of CD-ROMs that have accumulated at Chaos Manor. Now I'm off to the Hackers' Conference. This year I'm taking MIT's Marvin Minsky, which ought to prove interesting. ■

Jerry Pournelle holds a doctorate in psychology and is a science fiction writer who also earns a comfortable living writing about computers present and future. Jerry welcomes readers' comments and opinions. Send a self-addressed, stamped envelope to Jerry Pournelle, c/o BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. Please put your address on the letter as well as on the envelope. Due to the high volume of letters, Jerry cannot guarantee a personal reply. You can also contact him on BIX as "jerryyp."

ITEMS DISCUSSED

Alloc-GC

personal version.....\$30
commercial version.....\$130

Codewright's Toolworks

P.O. Box 990

San Pedro, CA 90733

(310) 514-3151

Circle 976 on Inquiry Card.

Doc-to-Help.....\$295

(plus shipping and handling)

WexTech Systems, Inc.

310 Madison Ave., Suite 905

New York, NY 10017

(212) 949-9595

fax: (212) 949-4007

Circle 977 on Inquiry Card.

Dr. Solomon's Anti-Virus

Toolkit for DOS 6.01.....\$149.95

Dr. Solomon's Anti-Virus

Toolkit for Windows 6.01.....\$195

Ontrack Computer Systems, Inc.

6321 Bury Dr., Suite 15-19

Eden Prairie, MN 55346

(800) 752-1333

(612) 937-1107

fax: (612) 937-5815

Circle 978 on Inquiry Card.

LANtastic for Windows

A2Mbps Starter Kit.....\$499 to \$599

AE-2 Ethernet Starter Kit.....\$699 to \$799

AE-3 Ethernet Starter Kit.....\$799 to \$899

10Base-T Ethernet Starter Kit.....\$899

Artisoft, Inc.

691 East River Rd.

Tucson, AZ 85704

(800) 846-9726

(602) 293-4000

fax: (602) 293-8065

Circle 979 on Inquiry Card.

LaserMaster TrueTech 1000

Laserprinter.....\$6995

WinJet 300.....\$495

LaserMaster, Inc.

6900 Shady Oak Rd.

Eden Prairie, MN 55344

(800) 477-7717

(612) 944-9330

fax: (612) 944-0522

Circle 980 on Inquiry Card.

Norton Commander 3.....\$149

Symantec Corp.

10201 Torre Ave.

Cupertino, CA 95014

(408) 253-9600

fax: (408) 253-4092

Circle 981 on Inquiry Card.

Quotemaster Plus

base version.....\$89

professional version.....\$270

PennComp Software Development

Box 271529

Houston, TX 77277

(800) 326-6145

(713) 669-0965

fax: (713) 669-1014

Circle 982 on Inquiry Card.

SuperCard.....\$199

Aldus Consumer Division

9770 Carroll Center Rd., Suite J

San Diego, CA 92126

(800) 888-6293

(619) 695-6956

fax: (619) 695-7902

Circle 983 on Inquiry Card.

Windows for Workgroups.....\$249.95

Windows for Workgroups

Starter Kit.....\$849.95

Microsoft Corp.

1 Microsoft Way

Redmond, WA 98052

(800) 426-9400

(206) 882-8080

fax: (206) 936-7329

Circle 984 on Inquiry Card.

Unlimited connect time to access CompuServe basic services, now only \$7.95 a month.

You can start with the basics at a flat monthly rate, with extended services available on a pay-as-you-go basis.

For more information about CompuServe's new basic services, just mail this card, or call 1 800 848-8199.

Name _____

Company (If Applicable) _____

Address _____

City, State, Zip _____

Telephone (_____) _____ **CompuServe**

Byte/Feb.



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 407 COLUMBUS, OHIO

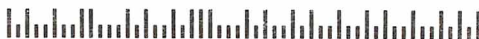
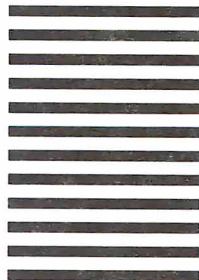
POSTAGE WILL BE PAID BY ADDRESSEE

CompuServe®

ADVERTISING DEPARTMENT

PO BOX 20212

COLUMBUS OH 43220-9988





With CompuServe, you'll always have more to look forward to.

It's one thing to discover something you like. But to realize there's more of it than you ever imagined is even better. And that's what CompuServe is all about.

Tap into travel information, hotel reservations, stock quotes, hardware and software support, a shopping mall, the news, interactive games, and forums. For the experienced user, there's even free software and shareware. On-screen menus and an index make it all easy to access, so you get the most out of your time and money.

A one-time membership fee and \$7.95 a month let you use our basic services as often as you like: news, sports, weather, shopping, reference materials, our E-mail service of 60 messages a month, and more. Plus, there's a whole universe of other services available at nominal additional charges.

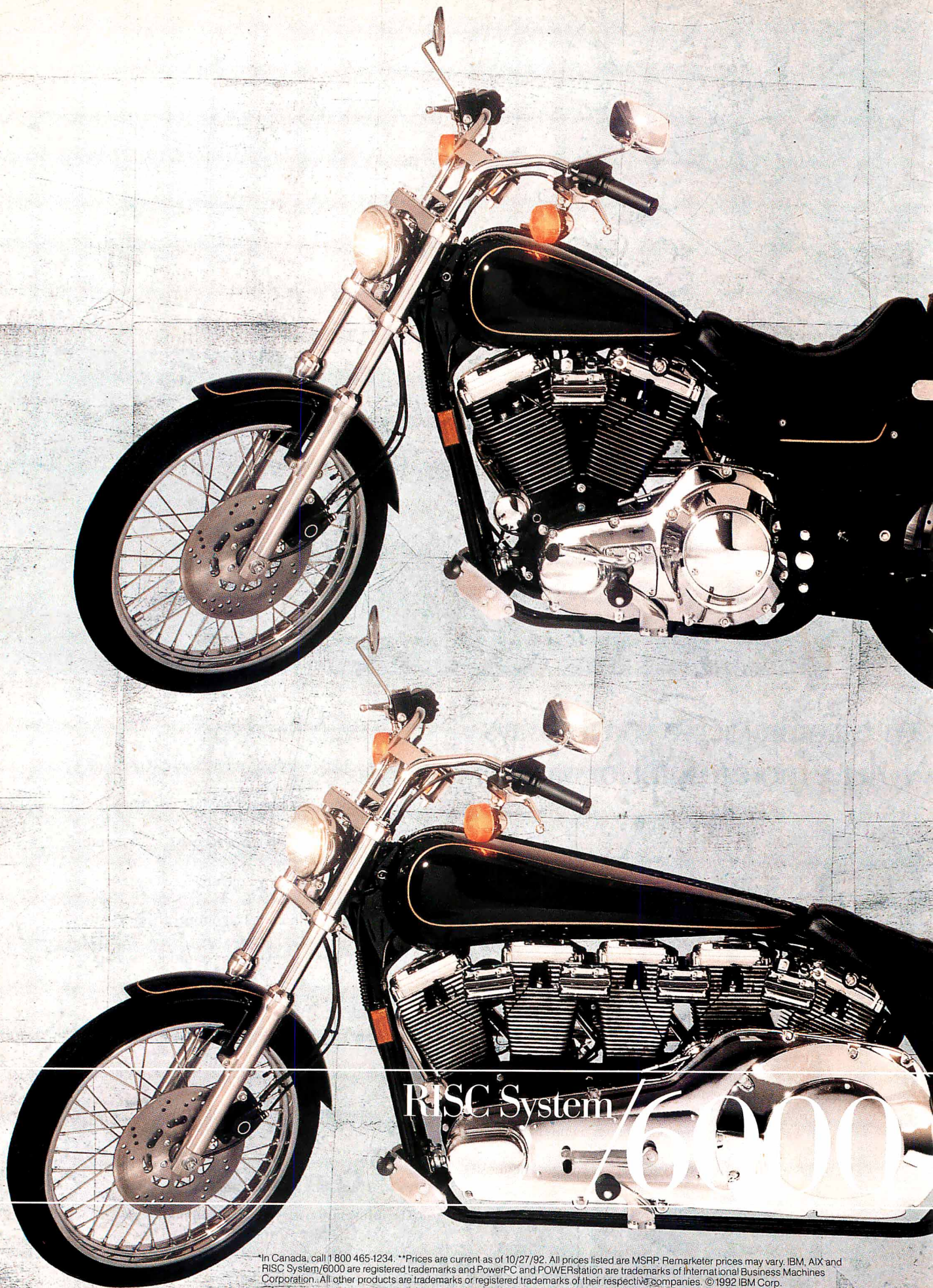
For more information or to order, see your computer dealer or call 1 800 848-8199. Outside the United States, call 614 457-0802. Because no information service lets you dig deeper or farther than CompuServe.

CompuServe®

The information service you won't outgrow.

UK 0800-289-378 CH 155 31 79 D 0130-3732

Circle 202 on Inquiry Card.



RISC System/6000

*In Canada, call 1 800 465-1234. **Prices are current as of 10/27/92. All prices listed are MSRP. Remarketer prices may vary. IBM, AIX and RISC System/6000 are registered trademarks and PowerPC and POWERstation are trademarks of International Business Machines Corporation. All other products are trademarks or registered trademarks of their respective companies. ©1992 IBM Corp.



The POWERstation 220: Here today.

When you're ready for raw power and performance at a low price, climb on a leader of the pack.

The RISC System/6000® POWERstation™ 220.

Cruise with leading UNIX® desktop price/performance today that has the kind of muscle and brains to keep pace with you tomorrow. And in the future when you're ready to rev up the performance, you'll be able to upgrade the 220 processor. It's even ready for the PowerPC™ 601 microprocessor model, which will offer up to two times the performance when available.

With AIX®, IBM's commercial-strength UNIX, you'll have access to more than 6,000 solutions. Solutions for software development, retail stores, accounting and transaction processing, just to name a few. And AIX is compliant with all leading UNIX industry standards. It also gives you the horsepower you need for distributed client/server applications and connectivity to systems from Sun,™ HP,® DEC® and IBM.

More tomorrow.

And don't forget IBM's unequalled service and support. You can count on us to install machines, configure networks and integrate all your systems, IBM or non-IBM.

So isn't it time you took this bad boy for a test drive?

Call your IBM marketing representative or Business Partner. For literature, call 1 800 IBM-6676, ext. 715.*

- *Upgradable to PowerPC.*
- *Great value today, growth for tomorrow.*
- *AIX, IBM's commercial-strength UNIX.*
- *Unequalled service and support.*
- *Complete systems start at \$5,950.***



Circle 90 on Inquiry Card.

Start the Presses

Affordable do-it-yourself CD-ROM publishing
will revolutionize how you distribute and use information

JON UDELL

When BYTE first featured CD-ROM on its cover in 1986, we said it would reinvent publishing. Today, CD-ROM is finally poised to deliver. CD-ROM drives are now faster and cheaper, and with the installed base (now estimated at 5 million) doubling every year, text-based and multimedia titles are proliferating. Kodak's Photo CD system establishes CD-ROM as a key ingredient in digital photography, and software makers are flocking to CD-ROM as a convenient alternative to distributing code and manuals. Businesses increasingly find CD-ROM a compelling medium for internal communication. And for governments obliged to distribute data to citizens, the medium of choice is becoming CD-ROM.

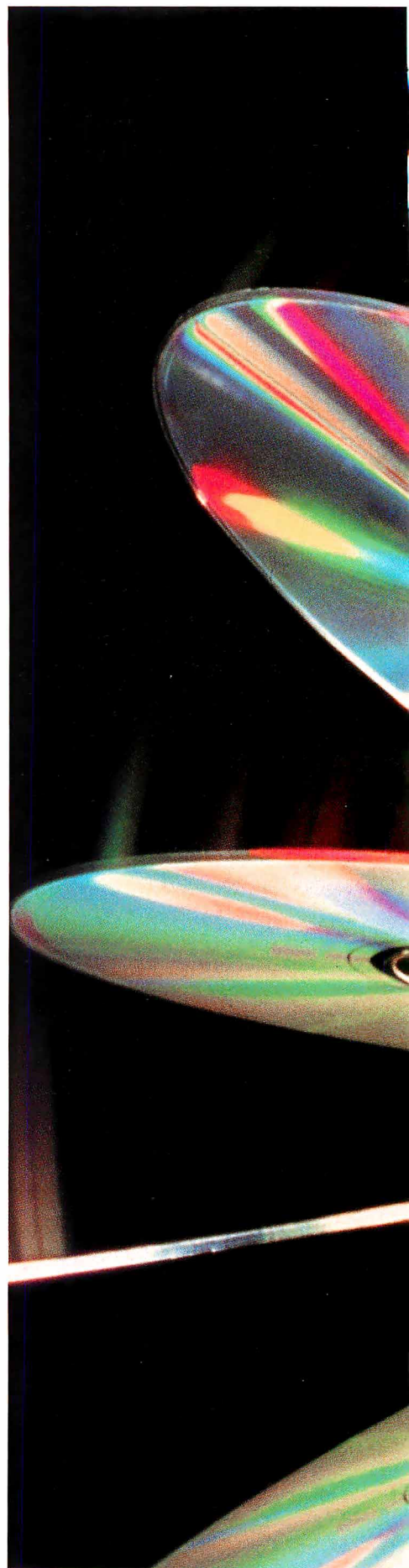
Into this bubbling mixture now drops a catalyst for even more rapid acceptance of CD-ROM: sub-\$10,000 CD-R (CD recordable) drives that bring CD-ROM-making to the desktop. These new low-cost printing presses will shift the electronic publishing revolution into high gear.

CD-R is ideal for three kinds of applications: prototyping titles destined for conventional pressing, final production of discs for limited distribution or even single use, and archiving. Low-volume production is CD-R's forte.

At the National Library of Medicine (Bethesda, MD), a research library within the National Institutes of Health, searching for medical periodicals until recently meant wading through fat notebooks full of printouts. Now that data finds its way onto a custom CD-ROM. A single copy of the disc, produced monthly using the Sony CD-R drive and placed in a networked CD-ROM reader, gives researchers electronic access to medical citations.

Macess (Birmingham, AL), a developer of turnkey document-control systems for the managed health care industry, uses CD-R to store scanned images of claims forms. The discs reside in huge banks of networked CD-ROM readers, and Macess's software marries CD-ROM-based document images to fielded data in Btrieve databases kept on NetWare servers. One of Macess's clients scans more than 10,000 forms a day. When the accumulated image data reaches 600 MB—which happens once or twice a day—it's written to a CD-R disc using a Philips drive. The total capacity of the system will soon double to 168 networked readers and nearly 100 GB of document images.

The SAS Institute (Cary, NC), developer of the statistical software package that is called SPSS, uses the Makedisc software from Young Minds and the Philips





Affordable CD-R Drives

JON UDELL AND HOWARD EGLOWSTEIN

Once you read your first hand-made CD-R disc in a standard CD-ROM player, you'll be hooked on the power of this exciting technology. Desktop CD-ROM recording is very new, though, and like any pioneer you should expect some of the hardships we encountered when we tested four of the current crop of CD-R solutions (see photo A). Their very different approaches to both hardware and software attest to the embryonic state of CD-R.

CD-Studio, YMI

We wondered how this deluxe solution for Unix-based CD-ROM makers could guarantee that a Unix host will sustain the 300 Kbps required by the double-speed Philips CDD 521 included with the package. The answer is that it doesn't have to. Young Minds, Inc., inserts a proprietary controller (shown in photo A) between the host and the recorder. The package sells for \$18,250.

The CD-Studio controller is essentially a headless PC (i.e., no monitor or keyboard) with two high-performance SCSI adapters and a 1-GB disk. One adapter handles communications with the Unix host; the other talks to the Philips recorder. The controller powers up running custom YMI code that makes it appear to Unix as an 8-

millimeter Exabyte tape device. To test that it's working, you can use the Unix `tar` command to copy files to the "tape" and read them back. What you can't do, though, is verify that the CD recorder is properly hooked up. We wish YMI had added LEDs to the controller's front panel to monitor the status of the recorder.

Our Unix test-bed was a Sun Sparcstation 2 running SunOS 4.1.2. YMI's *Makedisc* walked the tree of sources we fed it and built a 620-MB CD-ROM image on the controller's disk. To transfer that image to the recorder, we issued a standard Unix `mt` (mag tape) command, which tells the YMI controller's pseudo-tape device driver to start the recorder. After that, there's no feedback from the Unix console or the controller. You simply watch for the CDD 521's write LED to turn off.

Everything worked smoothly, and our first disc was a success, although even BYTE's Unix experts found YMI's documentation cryptic. Because we used *Makedisc*'s -R option to add Rock Ridge extensions, the resulting CD-ROM had the look of a Posix file system (e.g., long names, symbolic links, and permissions) when mounted in the Sparcstation's CD-ROM drive. (DOS and Macintosh systems saw the same disc as a standard ISO

9660 CD-ROM.)

Makedisc also stores descriptions of the Unix-to-ISO 9660 mapping in a text file at each node of the ISO 9660 tree. That way, Unixes other than the two that now support Rock Ridge (SunOS and NextStep) can recover the original names. YMI's `cd_link` enables such systems to map a hard disk-based tree of real Unix filenames to the corresponding tree of short, uppercase-only ISO 9660 filenames on the CD-ROM. YMI also provides an NFS (Network File System)-compatible file system called PFS (Portable File System) that handles CD-ROM sharing over Unix networks more efficiently than NFS.

Personal RomMaker, JVC

Mastering your disc on JVC Information Products' Personal RomMaker is about as easy as it gets. Personal RomMaker (\$12,799) requires a Mac IIci or better, 4 MB of RAM, System 7.x, and HyperCard 2.1 or higher. In addition, you'll need enough disk space to store your original data files, but there's no need for fast storage here: RomMaker can run happily off shared disks or network servers.

To burn a ROM, you need either fast access to the data files or a fast hard drive with a premastered image. JVC uses the latter and incorporates a high-speed Maxtor 8760 SCSI drive into the Personal RomMaker system (this is the same drive we chose for our DOS testing). You create your disc by deciding what files you want stored and how you want them arranged. RomMaker gives you a simple script editor for creating an ASCII list of these files and folders. We'd prefer it if RomMaker used standard Apple file dialogues for selecting files, but the ASCII file syntax is simple enough to handle.

The premastering stage runs through your file list and then copies each file from the Mac's file system to RomMaker's hard drive in CD-ROM format. You can choose from several disc formats: Apple HFS, ISO 9660, High



Photo A: (Clockwise from bottom left): The Sony CDW-900E, Philips CDD 521 (in Kodak guise), JVC Personal RomMaker, and YMI CD-Studio controller.

Sierra, or a hybrid HFS and ISO 9660 format. Our test disc consists of 620 MB of images. To find enough free disk space, we used System 7's file sharing to convert one of our Quadras into a file server. Over a thin Ethernet link, it took about 1½ hours to suck the 620 MB through the network and create the CD-ROM image.

After the premastering, you can mount the hard drive as a CD-ROM image, manipulate the folder and window structure, and test your application. To create the CD-ROM, you simply choose the appropriate menu selection. After verifying that you've placed a blank in the drive, RomMaker trundles off and copies the hard drive contents to the CD-ROM recorder. If you have the optional DAT (digital audiotape) drive, you can opt to copy the image to DAT for a commercial premastering house.

CD Record, Dataware

Dataware resells the Philips CDD 521 for the DOS market with its CD Record software (\$8995 for the package). Unlike Philips' CD-Write, which performs ISO 9660 formatting on the fly as it transfers files from a hard disk to the write-once disc, CD Record requires two steps: First build a virtual image, and then write that image to the CD.

First-generation premastering systems, like Dataware's CD Prepare, convert a DOS hierarchy that may contain thousands of files into one huge file that's a bit-for-bit image of an ISO 9660 file system. The image file serves two purposes. With the software emulator such systems typically provide, you can fool MSCDEX into seeing the image as a real CD-ROM. That means you can test your retrieval application before mastering any discs. Once satisfied with the image, you dump it to tape for shipment to a mastering house.

CD-R changes the rules of the game. Now you can build your own test disc, which is also a convenient delivery vehicle. In principle, there's no need for an image file, or for an extra 660-MB hard disk to store it on. But given the high cost of CD-R media, it's still useful to have an image file available for preliminary testing. CD Record's virtual image meets that need—without doubling your storage requirement—by adding a thin ISO 9660 mapping

layer to an existing DOS file system.

CD Record has some drawbacks, though. Building that image took us over an hour for our 8000-file data set, and that still left an additional half hour to cut the disc. By contrast, CD-Write, although lacking the useful virtual image capability, does the entire job—formatting and disc cutting—in half an hour. Also, CD Record's virtual image lives in RAM and does not survive a reboot. If you need to make a CONFIG.SYS change after running vmap (the ISO 9660 mapper) but before starting cdrecord (the recorder), you'll have to rerun vmap—an inconvenience that Dataware admits should be fixed.

Hardware trouble botched our first two discs. While DOS can disgorge files fast enough to sustain 300 Kbps to the double-speed CDD 521 for the duration of a write session, conditions must be near-optimal. After rearranging some questionable SCSI cabling, we did successfully cut discs. But the experience reminded us that a more expensive solution involving a dedicated hard disk (e.g., YMI, JVC) is also inherently more reliable.

Multimedia Formatter, Sony

Sony's rack-mountable CDW-900E (not sold at retail) offers several unique features. In addition to the SCSI-2 connectors, its back panel sports an extra pair of proprietary connectors. These enable you to link a master CDW-900E to as many as 15 slaves for simultaneously writing multiple CDs. (Additional connectors, not currently used in any PC-hosted application, support recording audio CD.) The drive's capacious 3-MB buffer helps ensure the sustained flow of data on which CD recording critically depends. Moreover, since it can run at single or double speed, the host need not support the 300 Kbps required by the Philips drive.

Like CD Record, Sony's Multimedia ISO Formatter layers a virtual image on top of an existing DOS file system. However, it provides no emulator, nor can the drive work as an ordinary CD-ROM reader (as the Philips drive does). When you cut a disc from a virtual image, Sony runs the drive at single speed to ensure best results. For faster writing, you have the option of building a real image on the hard disk and cutting it to the disc at double speed.

Like the drive itself, Sony's formatting software has some unique features. In addition to straight ISO 9660 CD-ROMs, it can apply the secret sauce needed to make titles for Sony's Data Discman and MMCD Player. The Data Discman plays 8-centimeter discs that are in XA format but have nonstandard volume information. Another secret recipe makes the MMCD Player's regular-size XA discs. Sony's formatting software, which presents a DOS-based GUI, supports both these formats.

For Unix users, YMI's CD-Studio, with its Rock Ridge support, is a solid—albeit pricey—solution. Mac users who can afford JVC's Personal RomMaker will appreciate its outstanding ease of use and HFS support. For DOS users, both the Sony and Philips drives have their advantages. The Sony CDW-900E's large buffer and single-speed mode could improve reliability in some configurations, and its support for Sony's Data Discman and MMCD Player is unique. The Philips drive, widely supported by resellers, is a solid performer and—at least for now—the most inexpensive CD-R solution.

Jon Udell is a BYTE senior technical editor at large. Howard Eglowstein is a BYTE Lab testing editor. You can contact them on BIX as "judell" and "heglowstein," respectively.

COMPANY INFO

Dataware Technologies, Inc.

(617) 621-0820
fax: (617) 621-0307

Circle 1075 on Inquiry Card.

JVC Information Products Co.

(714) 965-2610
fax: (714) 968-9071

Circle 1076 on Inquiry Card.

Sony Corp. of America

(800) 352-7669
(201) 930-6432

Circle 1077 on Inquiry Card.

Young Minds, Inc.

(909) 335-1350
fax: (909) 798-0488

Circle 1078 on Inquiry Card.

Buying a CD-ROM Drive

TOM HALFHILL

The proliferation of CD standards, including CD-ROM XA and multisession Photo CD, makes it harder than ever to decide which drive to buy. Further complicating the decision is the availability of dual-speed drives that, for a \$200 premium, double throughput. One alternative is simply to wait a few months: Drive makers are constantly updating their products, and they say that adding XA or Photo CD support won't be a big deal. But the definitions of these features can be slippery.

Consider NEC's "XA-ready" drives, which can read mode 2 format. To be fully XA compatible, they will need additional circuitry to decode interleaved channels of audio and perform ADPCM (Adaptive Differential Pulse Code Modulation) decompression. To add these capabilities, you're likely to need a new interface card. The same is true of XA-ready drives made by Sony and others. Currently, the only Sony devices with built-in ADPCM chips are the Data Discman and the MMCD Player. Sony says, however, that it will add the relatively inexpensive ADPCM chips to its CD-ROM drives if XA compatibility becomes more important.

So far, the most compelling reason to have XA is Kodak's Photo CD. To read a Photo CD, a CD-ROM drive must be XA ready, although it does not have to be fully XA compatible. However, full XA compatibility with

ADPCM will be required for future Photo CD applications that will use interleaved audio. Lacking ADPCM, an XA-ready CD-ROM drive could play sound bites attached to individual images, but it couldn't play a continuous audio track while reading one image after another. For an impressive business presentation or narrated slide show, you'd need full XA.

Another desirable feature in a CD-ROM drive is the ability to read multisession Photo CDs. Several drives can read the first batch of images written to a Photo CD disc. But when you add another batch of pictures, it becomes a multisession CD, and only a handful of drives can track the modified directory structure and locate the additional images.

"I don't think multisession is a big deal," says Pat Fobes, a CD-ROM hardware manager at NEC Technologies (Wood Dale, IL), "but Kodak is putting a lot of marketing behind the idea of multisession, and the public perception will be that multisession is important." As a result, virtually all major manufacturers will be adding multisession capability to their new drives. Usually it requires a patch to the drive's firmware, plus some modifications to the servo tracking system so the device knows what to do when the laser pick-up stumbles on an unrecorded region of the disc. Such modifications add little or nothing to the retail price of

a CD-ROM drive.

If you opt for a dual-speed drive, though, you will pay a premium. NEC introduced this feature in 1992, and it's catching on fast. To see why, compare the specifications: A typical single-speed drive might have an average seek time of 450 milliseconds and a data transfer rate of 150 Kbps. A dual-speed drive's numbers might be 280 ms and 300 Kbps. Such performance is still anemic by hard drive standards, but it makes a big difference when you're reading high-resolution Photo CD images, which can run to 6 MB in size. The next frontier is likely to be 600-Kbps "quadspeed" drives like Pioneer's new DRM-604X.

Here's the bottom line. If you need a CD-ROM drive to access static information—encyclopedias, technical manuals, reference books, and so on—you can get by with an inexpensive single-speed drive without XA or multisession support. For multimedia CD-ROM applications involving sound and animation, consider a dual-speed drive for best throughput. If you anticipate using Photo CD at all, you'll need at least an XA-ready single-session drive. For serious Photo CD work, settle for nothing less than a dual-speed drive with full XA and multisession capability.

Tom Halfhill is BYTE's senior news editor in San Francisco. You can reach him on BIX as "thalfhill."

drive to build custom CD-ROMs for its Unix clientele. For each disc, SAS selects an appropriate subset of programs from its large family of products and uniquely serializes the programs to copy-protect them.

The U.S. Geological Survey (Reston, VA) has used CD-R since 1989. To equip its field offices, a \$60,000 Meridian solution that uses a Yamaha drive "was just too rich for the taxpayers' pocketbook," says Dave Traudt, manager of the USGS CD-ROM support center. Traudt placed low-cost CD-R drives in seven field offices and is buying four more. "Our agency has a very tight budget; that should tell you a lot about how we see recordable technology," he notes.

CD-R has been available to businesses flush with cash for several years. Now, affordable CD-R from Philips (the \$7995 CDD 521), Sony (the CD-900W, not sold at retail), JVC (the

\$12,799 Personal RomMaker and \$9995 Personal Archiver), and Pinnacle Micro (the \$4995 RCD 202) have put the technology within reach of a vast new segment of users (see the text box "Affordable CD-R Drives" on page 118).

One Drive Reads All

Without CD-R, CD-ROM mastering and replication require that the data, usually on 9-track tape or DAT (digital audiotape), be sent to an outside duplicator that uses the same multimillion-dollar equipment that stamps out audio CDs. The new recordable drives produce an equivalent product—CD-ROM discs containing files in the standard ISO 9660 format that ordinary CD-ROM players can read (see the text box "Buying a CD-ROM Drive" above). But CD-R (or CD Write-Once) discs aren't replicated from a master. Each is a custom edition that is made by copying data from a

The Quality Memory Solution

Phar Lap DOS-Extenders

New! 386|DOS-Extender™ 5.0
now supports
32-bit Microsoft® C/C++ !
CALL 617-661-1510

When your reputation's at stake...

We know how much work you put into building your product. Why use inferior tools that often create more problems than they solve? With a Phar Lap DOS-Extender, you know you're getting industry-leading, market-tested tools that have worked reliably for thousands of developers. Other DOS extenders simply can't measure up. Let Phar Lap show you what a DOS extender should be.

Build multi-megabyte DOS programs with Phar Lap's DOS-Extenders!

286|DOS-Extender™ - it's never been so easy! With our 286|DOS-Extender and your Microsoft C/C++, Borland C++ or Microsoft Fortran Compiler, you've got all the tools you'll need to quickly and easily build multi-megabyte protected-mode applications - often by simply relinking without making source code changes. Now you can build protected mode applications that access up to 16 megabytes of memory on any DOS-based 80286, 386, 386SX, or i486 PC - without changing development tools! 286|DOS-Extender is also compatible with both Borland's Turbo Debugger and Microsoft's linker and CodeView debugger.

386|DOS-Extender™ - the ultimate in 32-bit power. 386|DOS-Extender turns DOS into a true 32-bit operating system with a flat, 32-bit address space. Your program can access all the memory available in the machine - up to 4 gigabytes! 386|DOS-Extender runs on any DOS-based 80386, 386SX, or i486 PC, and has been used in over 800 applications, including AutoCAD 386 and IBM's Interleaf Publisher. It is backed by a full complement of 32-bit languages, including C, C++, Fortran, Pascal, Ada and Assembler. With true 32-bit performance, you can finally build workstation-class applications for the PC.

**Phar Lap Software: Chosen 10 to 1 over
all other DOS extenders. Here's why:**

	Phar Lap DOS-Extender	Vendor A	Vendor B
Maturity	Over 5 years and 1000 applications	Less than a year	Brand new
Memory Model	Safe	Dangerous	Dangerous
Compatibility	INT 1.5, XMS, VCPI, DPMI	XMS, DPMI	XMS, VCPI
Library Support	Extensive list of 32-bit libraries	Limited library support	Limited library support
Documentation	Extensive and detailed	Limited	Less than 50 pages

**640K
DOS
Barrier**

Shatter the 640K barrier and build multi-megabyte DOS applications.

**Overlay
Linkers**

No more suffering with overlays or EMS.

**Unsafe
Memory
Models**

Other DOS extenders can let common programming errors cause system crashes.



Trademark holders: 286|DOS-Extender™, 386|DOS-Extender™ - Phar Lap Software, Inc.; Interleaf Publisher™ - Interleaf Inc.; Windows™ - Microsoft Corp.; DESQview™ - Quarterdeck Office Systems. Registered trademark holders: Phar Lap® - Phar Lap Software, Inc.; AutoCAD® - Autodesk, Inc.; Borland® - Borland International, Inc.; Turbo Debugger® - Borland International, Inc.; IBM® - IBM Corporation; CodeView®, Microsoft®, MS-DOS® - Microsoft Corp.



Phar Lap Software, Inc.
60 Aberdeen Avenue
Cambridge, MA 02138
617-661-1510
FAX 617-876-2972

Circle 120 on Inquiry Card.

hard disk to a specially made blank disc.

The CD-R drive's high-powered laser burns pits into a pregrooved 120-millimeter disc that is a sandwich of polycarbonate substrate, organic dye, and a gold reflective layer (see figures 1 and 2). The half-hour or hour required for this transfer and the \$25 to \$40 cost of the blank dictate that CD-R will complement rather than replace mastering and replication.

Popular Publishing

All organizations collect and disseminate information. Several innovative ones now publish their parts catalogs, training manuals, technical documentation, and other forms of mission-critical data on CD-ROM. A CD-ROM disc is not only infinitely smaller, lighter, and cheaper to transmit than the equivalent tower of 200 Webster's dictionaries, but is also far more useful, because it is electronically searchable.

By lowering the barrier to entry, CD-R will dramatically expand the number of CD-ROM publishers and applications. Companies that produce discs using CD-R have to worry about the same duplication economics as before, to a point. Depending on the cost of the CD-R media, the break-even point for making copies using CD-R is between 20 and 100 discs. Above that, conventional replication will be cheap-

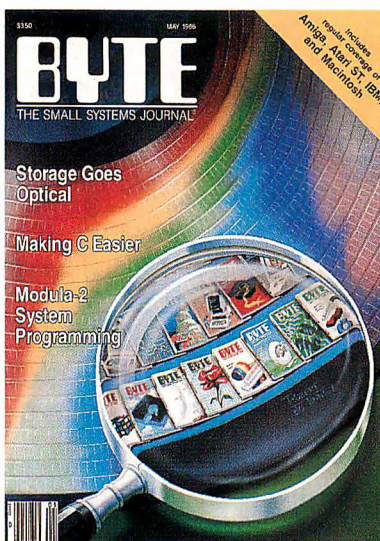


Photo 1: *BYTE* touted the promise of CD-ROM to revolutionize publishing on the cover of our May 1986 issue. Today, CD-R appears poised to deliver on that promise.

er (see figure 3 on page 131). In some cases, factors that aren't purely economic (e.g., convenience or security) could push the ball into CD-R's court.

While reviewing the CDD 521 Philips drive (see "Desktop CD-ROM Publishing," January *BYTE*), I built a prototype of a disc containing *BYTE*'s text from the last six years—a possibility suggested by the *BYTE* cover story on CD-ROM in the May 1986 issue (see photo 1). (The project had long been contemplated as a tool for editorial research.) The recordable drive made the project feasible, and being able to demonstrate a real CD-ROM disc galvanized support as nothing else could have.

I doubt that our situation is unique. CD-R's advent will spur countless fence-sitters to action. Says Larry Schiller, president and CEO of the Bureau of Electronic Publishing, a CD-ROM distributor (Parsippany, NJ), "Just about every business with sales of \$10 million or more will buy a recording drive."

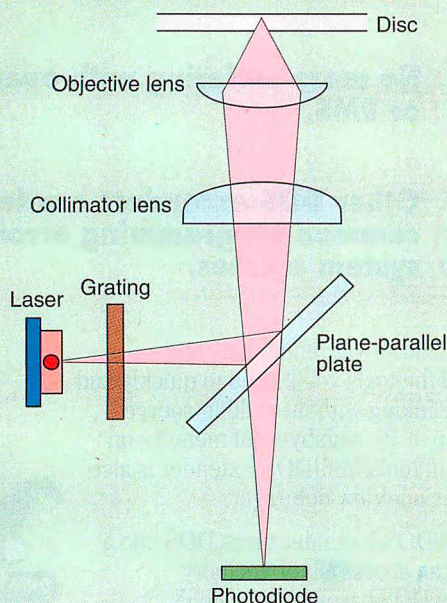
Internal disc production has security benefits, too. Military, government, or corporate users who must publish highly sensitive information on CD-ROM may not want to re-

lease that data, even temporarily, to an outside mastering facility. With a secure in-house CD-R system, the secrets can be safely reproduced.

continued

STANDARD VS. CD-R DRIVE LASER MECHANISM

a) Standard CD-ROM drive laser mechanism



b) CD-R drive laser mechanism

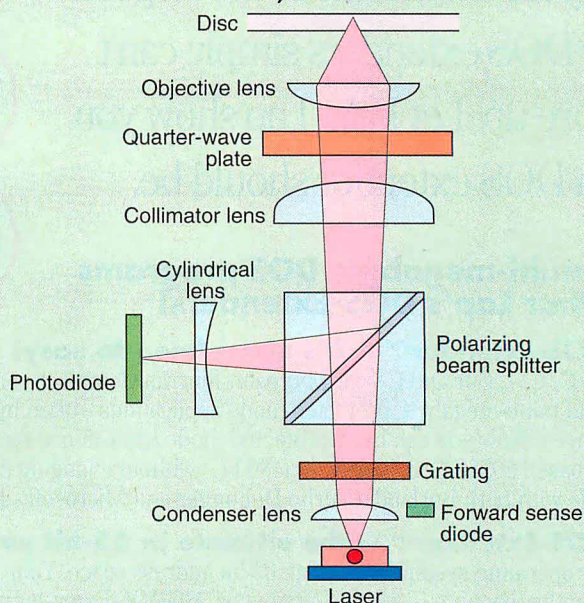


Figure 1: (a) In a standard CD-ROM drive, the laser's orientation is perpendicular. The beam takes a 90-degree bend en route to the disc and then reflects back to the photodiode. (b) In a CD-R drive, the path from laser to disc runs straight. The condenser lens couples the light to improve the laser's output, and the forward sense diode measures its intensity. The quarter-wave plate rotates the beam's polarizing direction twice, so the reflected light takes a 90-degree bend on its way to the photodiode. (Figures courtesy of Philips Consumer Electronics Co.)



Don't Shoot It, Troubleshoot It.

LANDMARK... the widest selection of PC diagnostic software, firmware, and hardware in the world!

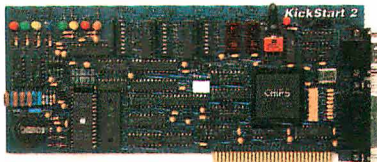
PC WON'T BOOT? KICKSTART IT!

Don't replace your motherboard, use **KickStart 2™**. When serious hardware problems occur, nothing gets you up and running as fast. KickStart 2 *measures power within 2.5% on all four voltages, shows Power-On Self-Test (POST) failure codes, and features on-board ROM-based diagnostics* allowing you to determine and remedy the problem quickly, easily, and inexpensively!

Built-in serial and parallel I/O *allows for testing remote via modem, or simply logging results to a remote terminal, printer, or laptop.* You can configure your own test routines and store them in KickStart 2's battery backed-up CMOS RAM for quick future use. On-board switches, LEDs, and digital displays allow complete control over testing in systems lacking video or disk.

KickStart 2 is the ultimate **SECURITY CARD**, too. With two levels of password protection and pre-O/S activation, you can confidently prevent unauthorized use of your PC.

Includes serial and parallel loopback plugs and the Landmark **JumpStart™** AT ROM BIOS for testing ATs that don't issue POST codes. KickStart 2 works independent of your operating system. You can use it on DOS or UNIX systems. **CALL for current pricing.**



"The number of tests KickStart 2 can perform is mind-boggling... IF THE KICKSTART 2 CAN'T FIND THE PROBLEM, IT PROBABLY EXISTS IN YOUR HEAD, not in the hardware."

Rich Santalesa, Computer Shopper

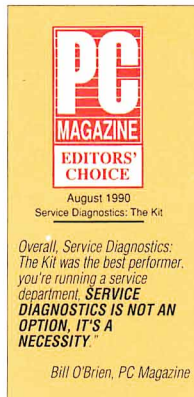
"KickStart 2 system diagnostics board helps users check out virtually every aspect of a PC's hardware system... THE BOARD IS A WORTHY INVESTMENT for computer maintenance."

David Claiborne, PC Week

PROFESSIONAL LEVEL PC TROUBLESHOOTING

Landmark **Service Diagnostics™** is ideal for professionals requiring the most exhaustive diagnostic test capabilities.

Service Diagnostics is not just a single product, but a complete LINE of products. It's comprised of software, hardware, and firmware so you can choose the best "tool" for the job.



Overall, Service Diagnostics: The Kit was the best performer. you're running a service department. SERVICE DIAGNOSTICS IS NOT AN OPTION, IT'S A NECESSITY.

Bill O'Brien, PC Magazine

When your PC won't boot, you'll need **ROM POST** firmware, a plug-in chip that virtually "jumpstarts" the system to determine what's wrong. And, when your printer isn't working, you won't know whether it's the LPT port, cable, or printer without hardware, like our loopback plugs (which together with our software completely test the COM ports).

To provide you a complete troubleshooting resource, Service Diagnostics is offered in single modules or in "kits." Components include; CPU-specific software (PC, XT, AT, 386/486, PS/2), ROM POSTS (PC, XT, AT) and floppy alignment disks (3.5" and 5.25").

All the Service Diagnostics software modules are available in self-booting versions for use with non-DOS operating systems like UNIX.

Service Diagnostics is powerful and flexible. Hundreds of tests can be performed on your motherboard, memory, video, COM ports, floppy and hard drives, printer, and more. **CALL for a customized quote on the kit that's right for you!**

PC DIAGNOSTICS MADE EASY

You don't need to be technical to use **PC Probe™**. With clear, intuitive, pull-down menus and 206 pages of on-line help, troubleshooting your PC is truly MADE EASY!

And, you don't have to be handy with a screwdriver to make PC Probe pay for itself. Just by providing a diagnostic report to your service and repair shop, you'll save money and receive quicker service.

PC Probe runs over 150 tests including; motherboard and CPU, memory, video card and display, keyboard, COM ports, floppy drive and controller, hard drive and controller, and more. Includes **VirusCure**, Landmark **Speed Test**, **AT SetUp** & loopback plugs. **CALL for current pricing!**



SLASH HARD DISK SET-UP TIME

If you install, upgrade, or maintain hard drives, then you need **DiskBase™**. It'll save you boat-loads of time and money by putting the exact hard disk information you need at your fingertips... whenever you need it.

DiskBase reveals 12 technical specs on over 2500 hard disk drive models and 8 technical specs on over 220 controllers. Once you've located the correct hard disk model, you can instantly bring up a listing of all compatible controllers. **CALL for current pricing!**

- Toll Free Tech Support
- 90 Day Money Back Guarantee
- Federal Express Shipping

CALL (800) 683-6696

FAX (813) 443-6603 • Int'l (813) 443-1331

LANDMARK
RESEARCH INTERNATIONAL CORPORATION
703 Grand Central Street • Clearwater, FL 34616



THE 5 MINUTE SOLUTION TO FLOPPY DRIVE FAILURE

With **AlignIt™** you can clean, diagnose, and align your floppy drives in minutes without a scope. Patented technology requires only a screwdriver to perform ANSI-accurate alignments (.3 mils).

AlignIt is ideal for corporate users with multiple PCs. The **GOLD STANDARD** feature allows you to align all your PCs to the same in-house standard, guaranteeing that all your floppies are perfectly interchangeable between PCs! Available in 3.5" or 5.25" for both high and low densities. **CALL for current pricing.**

Copyright © 1992. PC Probe, AlignIt, KickStart, JumpStart, ROM POST, Service Diagnostics, DiskBase, and Speed Test are trademarks of Landmark Research International Corp. All Rights Reserved. Other names are trademarks of their associated owners.

Circle 136 on Inquiry Card (RESELLERS: 137).

The New Breed of CD Players

ED PERRATORE

Three unusual CD players debuted in 1992: Sony's MMCD Player, Tandy's VIS (Video Information System), and Philips' CDI 360 Portable. Each uses a different processor, operating system, and CD format (see the table). The common threads are CD-ROM and NTSC output. These three specialized CD appliances are all equipped to play on your TV.

The VIS, restricted to that mode, most clearly targets the home market. VIS applications use a Windows derivative called Modular Windows, which presents a simplified interface on a TV screen and takes user input from an infrared remote control. Developers will use familiar Windows tools to create VIS applications and can readily port MPC titles to the new platform. Owl International (Bellevue,

WA) and AimTech (Nashua, NH) have announced authoring tools to support the VIS.

Initially, the VIS CD-ROM drive supports neither single-session nor multisession Photo CD. However, the VIS is eminently upgradable, with sockets for a video accelerator and a modem. "It's the most open-architecture computer out there," says Richard Doherty, editor in chief of the multimedia newsletter *Envisioneering* (Seaford, NY), "but Tandy will say, No! No! It's not a computer, it's an appliance!"

The Sony and Philips players, which can connect to a TV or run stand-alone, double as entertainment or educational appliances and as business tools. *Newsweek's* recently announced *Newsweek Interactive*, a quarterly CD-ROM version of the magazine, will showcase

the MMCD Player as a home entertainment device. Northern Telecom's new diagnostic application for PBX systems will put the MMCD Player to work. The company's 3700 field technicians will soon be able to connect the Sony unit's serial port to PBX switches, run diagnostic software, and hot-key to a 30,000-page store of searchable documentation.

Philips' CDI 360 can also play in both consumer and business markets. The company is marketing CD-I as a better platform than CD-ROM XA for integration of audio, video, text, and graphics. An alliance between Dataware Technologies and Philips subsidiary OptImage brings the data-crunching capability of traditional CD-ROM retrieval software to the sight-and-sound world of CD-I.

Although the MMCD Player's use of the CD-ROM XA format theoretically enables it to share titles with ordinary PCs that have XA drives, there are obstacles. Most XA drives sold today don't come with the hardware support (ADPCM [Adaptive Differential Pulse Code Modulation] decompression and deinterleaving) that Sony's embedded XA chip set provides. Also, the Sony unit's small display and lack of a hard drive make it incompatible with current XA-based PC applications.

For Philips, the cost of CD-I hardware and development tools is an impediment, as is the royalty the company charges for use of the CD-I name. "When you say 'CD-I,' you are mentally writing a check to Eindhoven [the Netherlands base of Philips Electronics NV]," says Doherty, "and that rubs a lot of people the wrong way."

Ed Perratore is a BYTE news editor based in New York. You can reach him on BIX as "eperratore."

CD-ROM DRIVES FOR YOUR TV

The VIS, with no display of its own, allows output options to near-VGA 640- by 400-pixel and lower resolutions in addition to NTSC. Part of the CDI 360's price is for a 6-inch active-matrix color display unmatched by the MMCD. (N/A = not applicable.)

	CDI 360	MMCD	VIS
Processor	68000	8086	286
Operating system	OS/9	DOS	Modular Windows
Disc format	CD-I	CD-ROM XA	CD-ROM
RAM	8 KB nonvolume	640 KB	1 MB
Attached display	Yes	Yes	No
Serial port	Yes	Yes	No
Display resolution (pixels)	756 × 556	300 × 200	N/A
Compressed audio in hardware	Yes	Yes	No
Full-motion video in hardware	Available first quarter 1993	No	No
NTSC output	Yes	Yes	Yes
PAL output	Yes	No	No
Portable	Yes	Yes	No
Price	\$2000	\$1000	\$700

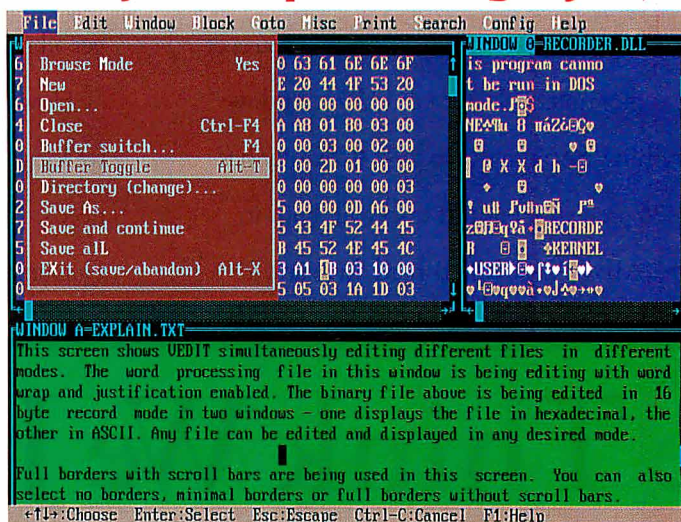
One-of-a-kind discs could also be useful business development and sales tools, says Rich Bowers, executive director of the OPA (Optical Publishing Association) (Columbus, OH). Each year, 100,000 companies bid to sell their wares to the U.S. government, and a response to a federal request for proposals can run

to hundreds of pages. Similarly, pharmaceutical companies require heaps of documentation to obtain FDA approval for new drugs. Submitting the required 20 copies of your proposal on CD-ROM, says Bowers, is easier for you to send and for the recipient to evaluate. CD-ROM also gives you the option of making a more

The Worlds First Universal File Editor

Edit Any Text/Data/Binary File Up To 2 Gigabytes

- Unique multi-mode, multi-file editor handles any text, data or binary file.
- Edit DOS, Unix and Mac text files, fixed and variable length data records.
- Edit in ASCII, Hexadecimal or EBCDIC, or combination of modes.
- Edit database, mainframe, Postscript, .EXE and other non-standard files.
- Hyper-browse CD-ROM files.
- Full featured program editor.
- Convenient word processing.
- Also VEDIT for only \$89.



Until now, data files, such as database files, downloaded mainframe files, Postscript and plotter output, .EXE executables and other non-standard files were a real headache if you ever had to view, patch, search, search/replace or extensively edit them.

Traditional text editors can't handle these files because they are non-standard or too big. Traditional disk utilities allow only the most primitive viewing and patching. Just a single corrupted data file could take days to fix, and you sweated and cursed the whole time.

A new way to handle data files

VEDIT lets you edit data files as effortlessly as text files. Its secret is incredible speed, huge file capacity and special editing modes.

File modes support DOS, Unix and Mac style text files plus data files with fixed length or variable length records. Display modes include five ASCII modes, Hexadecimal and EBCDIC, or split the screen for any combination. Search using pattern matching or regular expressions, cut and paste data files, and much more. Long lines can be horizontally scrolled or wrapped onto multiple screen lines.

Handle nasty "text" files too

Text files may sound easy to edit, but other editors choke when they hit embedded control (null) characters, very long lines or the 400 Megabyte file you are trying to put onto a CD-ROM. VEDIT handles all text files effortlessly and automatically detects the correct file type. With VEDIT you can conveniently edit any file you will ever encounter.

Speed, speed, speed

Only VEDIT has the speed to edit multi-megabyte files. Traditional text editors such as Brief(tm) and Sage(tm) are much too slow to edit files much larger than memory; and Multi-Edit(tm) is 7 times slower than VEDIT. And none of them can efficiently edit data files.

	VEDIT	Brief	Multi-Edit	Sage
Edit data/binary files	Yes	No	Some	Some
Support fixed-length records	Yes	No	No	No
Maximum line length	Unlimited	512	2048	65K
Maximum file size	2000 Meg	32 Meg	32 Meg	100 Meg
Hex/EBCDIC editing	Yes/Yes	No/No	No/No	No/No
Multiple display modes	Yes	No	No	No
Fast browse of CD-ROM	Yes	No	No	No
Global search/replace in 10 Meg file	2:49 min	>24hours	20.0 min	2:10 hour

Ultimate programmer's editor

Long a favorite among programmers, VEDIT has every advanced feature you might expect. Simultaneously edit numerous files, split the screen into windows, search/replace with regular expressions. Automatic indent, block indent, parentheses matching and block operations by character, line, file or column speed program development. Word wrap, paragraph formatting, justification, centering and many printing options are ideal for text processing.

Its unique compiler support integrates tools from different vendors and fully supports "make". VEDIT PLUS has the most powerful macro programming language of any editor. It's ideal for translating files from one format to another.

Easy to learn, easy to use

An intuitive user interface with drop down menus, hot keys, mouse support, optional scroll bars, context sensitive help, point and shoot file selection and unlimited keystroke macros make VEDIT PLUS easy to use, easy to learn. Safety features include 1000 level undo, auto-save and optional backup files.

The entire keyboard layout and everything in VEDIT is configurable with easy to use menus. With over 100 configuration parameters you can fine-tune VEDIT to your exact needs and preferences.

Installation is trivial. Only the 85K VEDIT.EXE is required (no overlays) and a full installation is only 500K.

DOS

UNIX

QNX

FREE Fully Functional Demo!
Call 1-800-45-VEDIT

Confidently order your VEDIT PLUS today; it comes with a 30 day money-back guarantee. VEDIT has been the choice of 100,000 programmers, writers and engineers since 1980.

VEDIT PLUS - DOS single user license: \$185; DOS network 5 user license: \$385; UNIX/XENIX, QNX, FlexOS/IBM 4680: \$285.

A new, fully functional demo of VEDIT PLUS and a shareware VEDIT Jr. are available on our BBS at (313) 996-1304.

Toll Free: 1-800-45-VEDIT (1-800-458-3348)
Telephone: (313) 996-1300, Fax: (313) 996-1308
Mail: P.O. Box 1586, Ann Arbor, MI 48103

VEDIT is a registered trademark of Greenview Data, Inc. All other product names are trademarks or registered trademarks of their respective holders.

Circle 72 on Inquiry Card (RESELLERS: 73).

Greenview Data

VEDIT PLUS - Universal File Editor

And for good reason. Because CompuAdd Express is the only one that can bring you everything you ever wanted in a color notebook—for just \$2,795. And we mean everything. Because the Express 425Color has a 25MHz 486 processor, built-in trackball, built-in fax/modem, 8MB RAM, 120MB hard drive and a

capability for more effective presentations. And you get all this for just \$2,795.

How can we do it? Because at CompuAdd Express, we focus our energy on our customers and their needs. That's why we offer the CompuAdd Express Guarantee, an outstanding combination of services

We Think We Just Heard A Collective Groan From Our Competition.

passive matrix 640x480 display. So your graphics pop, your Windows icons and command boxes will be easier to use and all your applications will be more enjoyable. Plus, you can take advantage of simultaneous display

Standard With Every CompuAdd Express System

- 30-day money back guarantee
 - Express 30-day exchange
 - One-year limited warranty covering replacement or repair of defective hardware
 - Rapid repairs
 - Toll-free technical support
 - Remote Rescue online technical support
 - Technical bulletin board service
 - The convenience of Express Leasing
 - Easy credit when you have an Express credit card
-

and support no buyer should be without. And you can buy from us with confidence, because we're a spin-off of CompuAdd, the company that pioneered direct marketing of computers 10 years ago. As a result, our Tech Support staff averages more than five years experience, and our Customer Service staff averages more than nine. So we know what we're talking about. And we're ready to help. With this impressive combination of technology, engineering, service, commitment and low price, it's no wonder our competition is groaning. And no wonder our phones are ringing. Because when you're looking for the best value, it all adds up to CompuAdd Express.



Cyrix CX486SLC processor
rated at 25 MHz

120MB hard drive.

Presentations are easy with
the 425Color's simultaneous
display. Use the external
VGA video connector to
display data and graphics
on your notebook and
a full size monitor at the
same time.

Passive matrix LCD display
with 640x480 resolution.
Measures 8.5" diagonally.

Built-in 9600 baud fax/2400
baud modem, both with
send/receive capability.

Built-in mouse trackball
with 200 dots per inch
resolution.

Drawer makes adding
a coprocessor easy.

The total system weighs
only 6.3 pounds—including
battery.

Click buttons are
on the side.

Measures 8.5"x11.5"x2".
Chassis has a suede
texture finish.

\$2,795



Charge batteries three ways—
in notebook while you're
using it, in the notebook
while you're not using it
or in our optional battery
charger (charges two
batteries at once).

The 425Color warns you
two ways when its battery
is low—with a beep and a
blinking light.

8MB of RAM

Display controls are beside
the screen on the right.

Standby button shuts
down display and drives
when you close the lid but
preserves data.

Power switch located on
the keyboard surface.

84-key layout implements
the functions of a standard
101-key keyboard.

The inverted "T"
configuration for arrow keys
is conveniently located.

A 1.44MB 3.5" internal
floppy drive.

FREE Windows 3.1, MS
DOS 5.0, LotusWorks 3.0,
Close-Up 4.0, international
adapter and carrying case –
OVER \$600 VALUE!

Express 425Color Notebook

Lease for only \$103/mo.

Express 425XL Notebook

- Cyrix CX486SLC processor rated at 25MHz
- Over 3 hours of battery life (depending on application, individual use and power management)
- Math coprocessor socket in drawer for easy access
- Super-twist backlit liquid crystal display
- Display: 8.5" usable diagonally
- 64 levels of grayscale
- 9600 baud fax/2400 baud modem, FREE Bit-Fax software
- 120MB IDE hard drive
- 1.44MB 3.5" internal floppy drive
- 4MB RAM upgradable to 8MB
- Built-in mouse trackball
- Serial and parallel port, PS/2 keyboard connector
- External VGA video connector for simultaneous display
- Only 6.3 pounds including battery
- FREE Windows 3.1, MS DOS 5.0, LotusWorks 3.0, Close-Up 4.0, a free international adapter and carrying case – OVER \$600 VALUE!

\$1,995

Lease for only \$73/mo.

Call to order or to request a free catalog.

CompuAdd *Express*

800-925-3525

12301 Technology Boulevard
Austin, Texas 78727
Hours: 8am-6pm (CST) M-F
512-219-1800 Fax 512-219-2890

number. CompuAdd Express sells and services equipment within the United States only and will pay no customs, duties or tariffs on returned merchandise. Prices and product descriptions are subject to change without notice. CompuAdd Express is not liable for damage due to omissions or typographical errors. A copy of our limited warranty is available prior to sale from your sales representative. Pre-installed MS DOS 5.0, Windows 3.1, LotusWorks 3.0 and Close-Up 4.0 are OEM versions.

Circle 71 on Inquiry Card.

CD-R MEDIA COMPOSITION

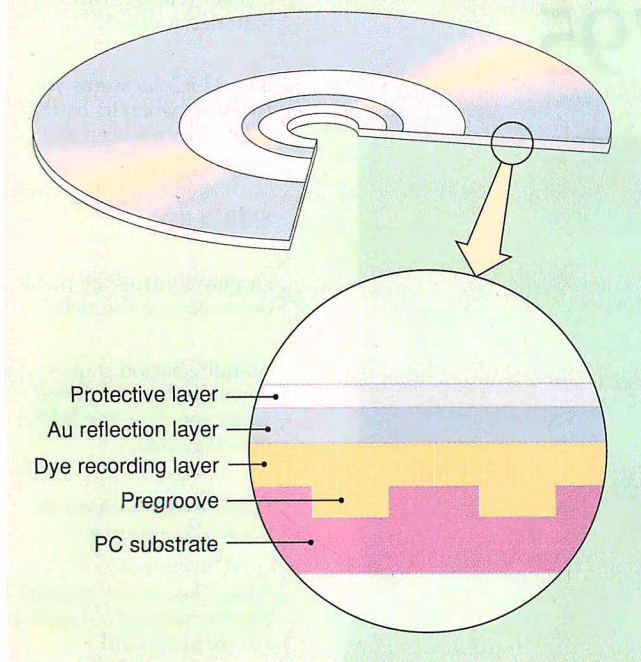


Figure 2: The CD-R media consist of four layers: the top protective layer, the gold (Au) reflection layer, the dye recording layer, and the PC substrate. The CD-R laser heats the reflection, recording, and substrate layers. As a result, the recording layer fuses and is impressed by the expanding substrate layer. (Figure courtesy of Philips Consumer Electronics Co.)

impressive sales pitch by jazzing up the content with sound and video.

For governments, a compelling use of CD-R will be to satisfy requests for information. Conventional CD-ROM publishing has already improved matters tremendously. Topographical and geological survey data used to cost \$100 per 9-track tape. Now you can get it on CD-ROM for \$32, says George Knapp, a USGS abstracts editor and chairman of SIGSOFT, a group that evaluates CD-ROM authoring and retrieval tools. "For public access to data," he says, "CD-ROM is the greatest thing that's ever happened."

The Office of Business Analysis in the U.S. Department of Commerce (Washington, DC) publishes the National Trade Data Bank on a CD-ROM that amalgamates import/export data, marketing studies, and foreign-aid program information from 15 federal agencies. The disc helps U.S. exporters understand international markets. A second title that delivers U.S. economic, social, and environmental data will soon be available.

CD-ROM discs produced under federal auspices are almost always replicated, even if they're ultimately sold only in small numbers, because copies must be distributed to the federal depository libraries—a group of some 1250 university and public libraries that agree to store federal data issued through the U.S. Government Printing Office. Nevertheless, there is a need to publish individual discs on demand.

Daniel Costanzo, a physical scientist with the U.S. Army Topographic Engineering Center (Ft. Belvoir, VA), expects that customized slices of topographical data that today ship on 9-

track tape will eventually be delivered on CD-ROM discs. There's also an argument in favor of publishing some kinds of widely distributed data on demand. "If you print 10,000 CDs of GIS [geographic information system] data, it's like printing 10,000 maps," he says; "the currency deteriorates over time." In cases where demand-published CDs are feasible, users will always get fresh data.

The nature of that data will determine how well such a model works. Satellite and sonar images, which are just collections of files, are easy to dump to a disc. In the case of text or fielded data, however, the need to index the material will make it harder to carve out and deliver unique subsets.

Publisher Profiles

For CD-ROM publishers, testing discs prior to mass production was a complex ritual before CD-R. An emulator like Meridian's CD Publisher could make a hard disk-based ISO 9660 "image" written by an authoring tool look like a CD-ROM to the retrieval software. Such emulators can artificially slow access to the hard disk to help you gauge what the actual CD-ROM performance will be.

But one person sitting at the emulator's console can't fully explore the vastness of a disc and ensure that hundreds of megabytes of data have been properly assembled. For that, you need to make discs that can be distributed to a team of testers equipped with ordinary, inexpensive players. Suppose you need 10 such discs. Producing them by conventional means might entail a minimum order of 100, cost \$1500, and take three to five days. The CD-R solution, by contrast, yields just the 10 discs you need, for about \$300, in one day. "After you've gone around that track a few times," says Bill Harlow, a marketing manager at Philips Consumer Electronics (Knoxville, TN), "our drive has already paid for itself." On a tight deadline, the rapid turnaround of CD-R—for which mastering houses may double their fees—can be a critical factor.

The number of CD-ROM publishers is growing rapidly. Market researcher InfoTech (Woodstock, VT), which has tracked the CD-ROM industry since its inception, reports that last year the number of commercial and in-house titles grew from 3500 to 5000, and the installed base of drives more than doubled, to over 5 million (see figure 4 on page 132). At the same time, the CD-ROM retail market experienced dramatic change, according to the Bureau of Electronic Publishing. In 1991, fewer than 20 percent of the 17,000 computer-related retail outlets in the U.S. carried CD-ROM products. Last year, 80 percent did.

The Library Corp. (Inwood, WV) helps public and university libraries merge their own collections data with general sources such as indexes of periodicals, thereby creating custom titles unique to each library. Conventional replication is the technique of choice for bigger customers, such as the St. Louis Public Library, which has 141 networked readers. But CD-R is The Library Corp.'s ace in the hole for clients like Texas Christian University, which needs only a single disc.

Donnelly Marketing Information Services (Stamford, CT) makes CD-ROMs for market researchers. DMIS's director of software development, Mike Herman, says his company is investigating ways to create "onesie-twosie" discs for clients who want to merge their own data with the DMIS data. For Herman, the human cost of producing custom discs is by far the biggest issue.

At Hub Data (Cambridge, MA), a publisher of financial data on CD-ROM, CEO Bob Huebscher views CD-R as a way to deliver incremental updates to his monthly product. Huebscher sees the cost of CD-R blanks as a bigger obstacle. "I wouldn't think twice about a \$2 disc," he says, "and I'd consider \$10, but the current



Stop Looking

and start examining the brilliant, sharp image of our 17" Optique 4000D • With it's Invar Shadow Mask, you can display color intensive images that are razor sharp and 20% brighter than conventional monitors • Its flat, square screen offers a consistent overall, edge-to-edge image with reduced distortion at the corners • Higher refresh rates permit a flicker-free picture, and micro-processor controls allow 28 preset modes while adhering to strict Swedish MPR II low radiation standards • Your eyes will appreciate 36% more viewing area than 16" displays along with a non-glare screen and 1280 x 1024 resolution • And all this at a sensible price • So, if image quality at .28 dot pitch and 76Hz refresh rate meets your standards, stop looking and start dialing (800) 843-6784 • Ask about our award winning 2000D 15" flat, square screen, too.

OPTIQUE™

Circle 109 on Inquiry Card
(RESELLERS: 110)

Once and Future Standards

A flurry of emerging standards swirls around CD-ROM and CD-R. For starters, there's a new "color book" on the horizon. The Crayola box of CD standards (see figure A) has for some years included Red Book (CD audio), Yellow Book (CD-ROM), and Green Book (CD-I). (CD-ROM XA doesn't rate its own color; it works within Yellow Book's free-form mode 2 sectors.) Now there's Orange Book, which governs MO (magneto-optical) and CD-R drives. Part 1 of Orange Book defines a CD-ROM/MO hybrid. Part 2 defines single-session and multisession CD-R, and it is the subject of much current confusion.

Because the specification isn't nailed down, true Orange Book devices don't exist yet. Among CD-R drives, the Philips CDD 521 follows Orange Book most closely, although Philips admits a drive bought today might need a firmware upgrade next year. Sony has chosen to wait for a final specification before building multisession support into its CDW-900E. Alan Sund, Sony's (San Jose, CA) marketing manager for CD-ROM drives, says, "We're not going to have a compromised product claiming to follow a standard that doesn't yet exist."

Meanwhile, vendors of CD-ROM players—including Pioneer, Toshiba, Philips, and, yes, Sony—are scrambling to make their drives work with multisession Photo CD discs. Kodak, too, is betting that its own Photo CD player won't become obsolete by some last-minute change in the specification.

Why the confusion over multisession CD? Early developers of CD-ROM never anticipated CD-R. Users would read CD-ROMs, not write them, and a single session that could hold oceans of data hardly seemed limiting. (In retrospect, the handwriting was on the

wall. From the beginning there were "mixed-mode" discs that combined file-system data and audio tracks.)

Those same assumptions led to the ISO 9660 file system, which is both a great strength of CD-ROM and an increasingly troublesome limitation. ISO 9660's strength lies in its unique status as an operating-system-independent file system. An ISO 9660-formatted disc works identically on a PC, a Mac, or a Sun workstation. The disc may include operating-system-specific versions of a retrieval application, but each of these will access a common set of files. However, ISO 9660 is a least-common-denominator file system: It sacrifices features of the Mac (e.g., icons and resource forks) and Unix (e.g., symbolic links and permissions), and it doesn't permit updates.

There are two ways to make richer CD-ROM file systems. One is to make a non-ISO 9660 CD that uses a native Macintosh or Unix file system. That works, but performance can suffer since these file systems require special tuning for slow media. Also, you lose the vaunted interoperability of CD-ROM.

A second approach is to wrap operating-system-specific extensions around an ISO 9660 core. The Unix version of this technique is the Rock Ridge protocol, a compatible superset of ISO 9660. Unix systems equipped with the Rock Ridge extensions see a CD-ROM in Rock Ridge format as a Posix file system, complete with long filenames, permissions, and symbolic links. Other systems see the same collection of files as an ordinary ISO 9660 namespace. JVC Information Products' (Huntington Beach, CA) Personal RomMaker applies the same concept to the Macintosh. Its hybrid HFS/ISO 9660 mode makes discs that look like Macintosh volumes to Mac users but work for DOS and Unix users as well.

On the drawing board is a specification for a new CD-ROM file system. Known informally as the Frankfurt specification (officially, standard 168 of the ECMA [European Computer Manufacturers' Association]), it promises equal enrichment for Unix, Mac, OS/2, and Windows NT. Working hand-in-hand with Orange Book, Frankfurt will also support the incremental update capability that ISO 9660's designers never thought would be needed. The Orange Book/Frankfurt combination promises to make tomorrow's CD-R systems as easy to update as today's WORMs, while elevating the cross-platform CD-ROM standard to meet the needs of modern operating systems.

The catch? Everything breaks. Drives will need firmware upgrades, and no current CD-ROM software infrastructure will carry over to Frankfurt discs. That's why Young Minds' (Redlands, CA) president Andrew Young says of the Rock Ridge extensions he invented: "We're solving a today problem. Frankfurt solves a tomorrow problem."

CD-ROM COLOR BOOK STANDARDS

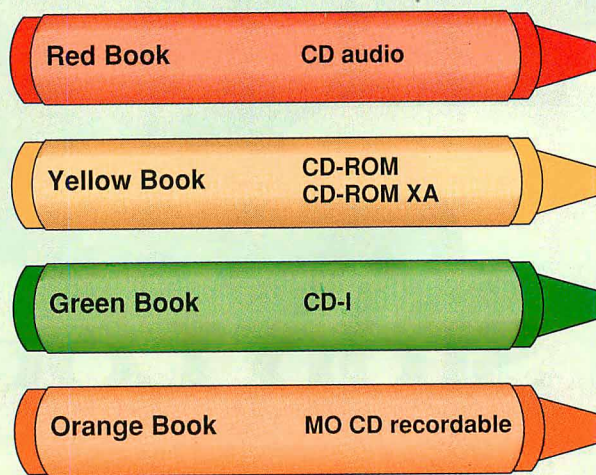


Figure A: CD-ROM standard specifications are categorized by color. The new color is Orange, which covers MO and CD-R.

\$25 just isn't in the ballpark." The frequency of publication combined with high media cost would shrink Hub Data's profit margins.

Not much can be done about the labor cost of CD-R production, although some drives (e.g., Sony's) can be used in parallel to produce multiple copies at a time. Media costs are falling, however; the only questions are how far and how fast. Eastman Kodak (Rochester, NY) predicts \$10 blanks in a few years. Is that likely? Much depends on the success of Kodak's Photo CD, a new imaging process that is the granddaddy of all CD-R applications. (Kodak writes Photo CD discs using the Philips CDD 521 drive.) Photo CD could be the engine that drives CD-R, just as audio CD powered CD-ROM. Moving just 1 percent of the film images processed each year into Photo CD format would create 5 million custom discs.

CD-ROM has also become a popular vehicle for software distribution. "We don't have final numbers yet," says InfoTech researcher Deborah Barlow, "but I won't be surprised if the number of discs used for software delivery exceeds those published for sale as commercial titles." Sun Microsystems, Hewlett-Packard, and Apple have long used CD-ROM to deliver software, but this year has seen many new entrants, including IBM (OS/2), Microsoft (Windows NT), and Borland International (Borland C++). Windows NT alone, still in prerelease, has already shipped on CD-ROM to 20,000 software developers.

The U.S. government is keeping pace with this trend as well. Allan Betts, CD-ROM production chief at the National Technical Information Service (Springfield, VA), says that the U.S. government produced 2000 titles last year, and he predicts rapid future growth. Betts, who advises dozens of federal agencies on CD-ROM production, says that one of the pressing plants his clients use now gets more than half its input in the form of CD-R discs rather than the traditional magnetic tapes.

Another segment builds multimedia titles for MPC, CD-ROM XA (Extended Architecture), and CD-I (Compact Disc Interactive) platforms (see the text box "The New Breed of CD Players" on page 124). The authoring tools these publishers use differ from the ones that create conventional titles, especially when the target is an XA or CD-I player that expects a mode 2 format incompatible with the mode 1 format of conventional CD-ROM (see the text box "Once and Future Standards" on page 130). But these distinctions exist purely at the logical level. To a CD-R drive, it's all just bits. Users of Mammoth Micro Productions' (Golden, CO) Studio/XA or OptImage's (West Des Moines, IA) MediaMogul test their XA and CD-I titles on the same CD-R drives that Dataware Technologies (Cambridge, MA) or SilverPlatter (Norwood, MA) customers use to develop standard CD-ROMs.

Manage Your Assets

As CD-ROM technology grows more practical, companies often find that they're unprepared to meet the challenge of what the OPA's Bowers calls "enterprise publishing." According to Bowers, CD-ROM has catalyzed a whole new view of the corporate information asset. "When you shift to this view," he says, "you suddenly find your whole structure [the way corporate data is stored] is upside down." Text kept in a random assortment of formats, tagged haphazardly or not at all, won't easily flow into a structured, possibly hyperlinked CD-ROM application.

Vendors of authoring and retrieval tools—including Fulcrum, Verity, and Personal Library Software—use fuzzy search and relevancy techniques, as opposed to standard Boolean searches, to minimize the need for structure. Fuzzy searches look for an approximate match; for example, a search for the word *war* might also turn up references to *conflict* or *battle*. Relevancy examines

the context of the retrieved text to determine the most appropriate hits.

Such products also support fields, however. Structure married to sophisticated full-text search capability is the most powerful combination. Electronic Book Technologies' (Providence, RI) DynaText exploits that combination in a striking way: When you do a search, it distributes the hits across the table of contents, so you can see at a glance which are the relevant chapters or sections. Thus, instead of getting hits on a per-document basis, you see how they relate to structure internal to documents.

How do you put in the structure? A consensus is rapidly emerging: SGML (Standard Generalized Markup Language). SGML is an extensible system for describing the structure and style of richly formatted documents (see "SGML Frees Information," June 1992 BYTE). Like many government-mandated standards, it bores the average person to tears. However, it is clearly the right way to manage text for dual use—that is, for simultaneous print and electronic publication. That's why both Novell and Silicon Graphics recently decided to migrate their documentation from proprietary formats to SGML. Avalanche Development (Boulder, CO) and Exoterica (Ottawa, Ontario, Canada) offer SGML conversion tools. Dataware Technologies' CD HyperText, which natively comprehends SGML, is an authoring tool that the company used to build a hyperlinked CD-ROM version of the U.S. tax code.

Another strategy for text is Adobe's Acrobat. Acrobat builds on two core technologies: Adobe's Multiple Master fonts, which can emulate the metrics of virtually any font, and a "reduced instruction set" PostScript that compresses files to a fraction of their normal size. The architecture includes a file standard, known as PDF (Portable Document Format), and software to convert

CD-R VS. CONVENTIONAL CD PRODUCTION

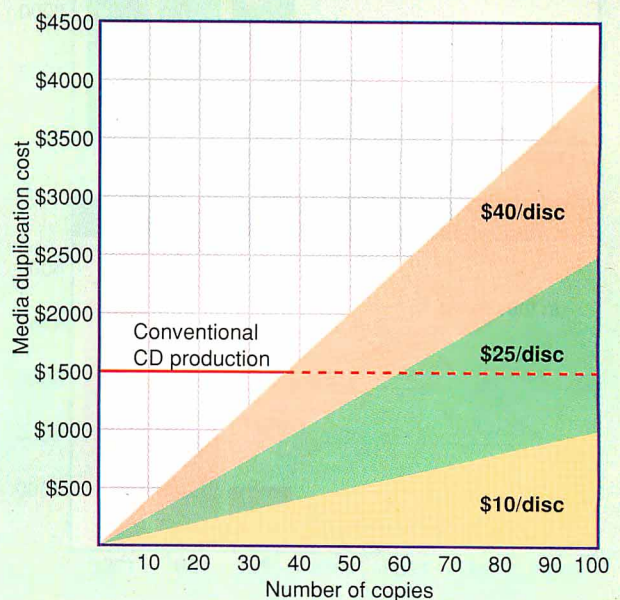


Figure 3: CD-R production pays as long as the number of copies stays relatively low. Conventional CD-ROM duplicators charge about \$1500 for 100 discs; that rate can double for one-day turnaround. At \$40 per disc, CD-R is cost effective for press runs of under 35. This chart does not take into account the cost of the CD-R drive or the cost of labor.

PostScript and non-PostScript documents into PDF format. Inexpensive software viewers that allow you to read and navigate PDF documents will be supplied first for Windows PCs and Macs and later for Unix, DOS, and OS/2 systems.

Using Acrobat, you can assemble documents created in a desktop publishing program such as PageMaker and run them through a batch Distiller that converts them to PDFs. Or you can use the PDF Writer to convert non-PostScript word processing files from Word or WordPerfect. Once these documents are written to a CD-ROM or other distribution medium, any system that hosts a viewer application can read them. In fact, viewers customized to read only the documents on a given CD-ROM can even be shipped with each disk. Note, though, that the first release of Acrobat won't support full text indexing.

The correct dual-use strategy for nontextual data is far less obvious. You can't just dump a Clipper or FoxPro application onto a CD-ROM disc and expect anything close to reasonable performance against large data sets. While the newer CD players can transfer data at a respectable clip, their slow seek times relative to those of hard disks remain a deadly impediment. Commercial tools like Dataware's CD Author use a variety of tricks to optimize for CD-ROM: loading B-trees fully (since they can't

grow in a read-only environment), storing indexes as separate files, and exploiting disc geography for best locality of reference. With these techniques, a simple search can take just seconds instead of many minutes.

Complex queries present even trickier problems, however. A SQL query that wanders all over the disc will take a year and a day, and it has no place to write its temporary indexes. Many producers of CD-ROM database products take a radically asymmetrical approach: They anticipate common queries, generate result sets in advance (often represented as bit maps), and write the prepared results to the disc alongside the data. Such preparation, which can take days of processing, gives users the illusion that their queries run almost instantly. Unfortunately, there's no simple or automatic way to convert a live transactional database into an optimized CD-ROM database.

Publishing for Posterity

CD-R clearly threatens WORM as an archival medium, although in the short run WORM's chief competitor will be MO (magneto-optical) technology (see the text box "Optical Flavors" on page 134). CD-R's compelling advantage is that you can read an archived disc in any CD-ROM player.

Creating that disc is complicated by three factors, however. First, you've got to translate the source file system (DOS, Mac, or Unix) into the neutral ISO 9660 file system that is the CD-ROM standard. Drives often provide formatters that convert on the fly as they write to the disc, but they may not handle some subtle naming conflicts. Hyphens are legal in DOS, for example, but not in ISO 9660.

Second, you must feed the drive a continuous stream of data. A dual-speed recorder, which fills a disc in a half-hour, needs a sustained 300 Kbps. That's only achievable from a fast hard disk in a controlled environment. Archiving a network drive must therefore be a two-stage process—one transfer to the CD-R workstation's hard disk, and then another to the CD-R drive. Finally, you'll want enough data on hand to justify the use of an expensive piece of media that can hold upward of 600 MB. Most CD-R drives don't yet support append operations (i.e., multisession recording), and none allow incremental file-oriented updates.

Other issues are the quality and longevity of CD-R media. NTIS's Betts found a distressing number of uncorrectable errors in early batches of CD-R discs he tested. Admittedly, Betts uses Enterprise Corporation of America's (West Des Moines, IA) CD-CATS (CD computer-aided testing system) to ferret out tiny defects that might well escape the notice of casual users. Still, "if Reed-Solomon [CD-ROM's error correction code] won't read," he says, "it is by definition not a CD-ROM." The CD-ROM specification requires functional error correction. Betts adds that the situation is improving rapidly.

Longevity is an open question for both CD-ROM and CD-R media. Since CD-R discs are burned, not pressed, they are more vulnerable to heat. Manufacturers also warn users to handle CD-R discs with greater care than CD-ROMs, implying that they're more fragile. But assuming that you take reasonable precautions with regard to heat and handling, there's no reason to think CD-R discs won't endure for 10 years, 25 years, or longer. It's even possible they'll outlast CD-ROMs, says Digipress (Louisville, KY) general manager Denis Oudard, an expert in archival CD-ROM. (His company's Century-Disc, a specialized \$495 CD-ROM made of tempered glass, aims to last hundreds of years.) "The Achilles' heel of conventional CD-ROM is the aluminum reflective layer," says Oudard; it oxidizes too easily. CD-R discs use gold, which is more stable.

You don't have to own a CD-R drive to archive your data onto a CD-ROM. If it's something you'll need to do only once, you can

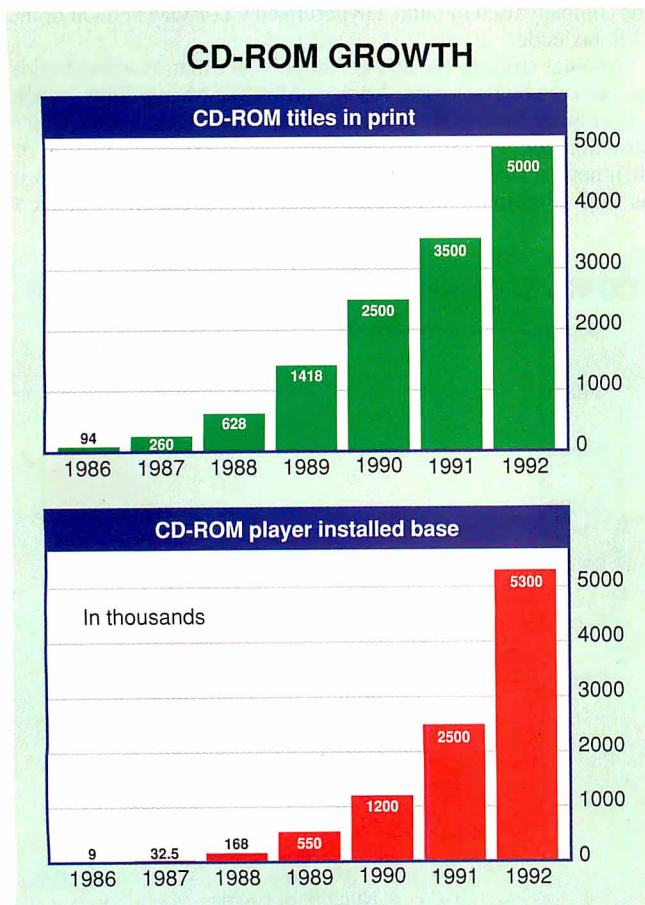
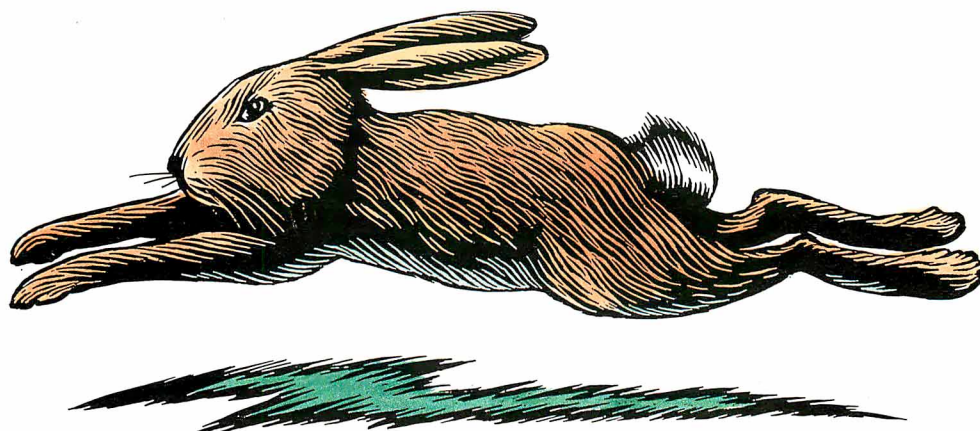


Figure 4: The global rate of growth in both the installed base of CD titles in print (top) and players (bottom) since the inception of CD-ROM technology has been significant and steady. The numbers shown here, courtesy of InfoTech, represent both commercial and in-house units. Note that InfoTech's more conservative accounting treats data sets that may span many discs as single titles.

ALSO AVAILABLE IN A NEW CD-ROM MODEL

NOW BACKPACK IS SMALLER. AND FASTER.



We've just made it easier to backup your hard drive with our 250 MB parallel port tape backup unit. One model works with all PC compatibles and portables.

Here's why:

Backpack is easy to install. Plug Backpack into the parallel printer port. Then plug the printer into Backpack!

Backpack requires no cards.

Backpack is 30% smaller (1.5" h x 4" w x 7.75" l).

Backpack is easy to transport and share between computers (2.5 lbs).

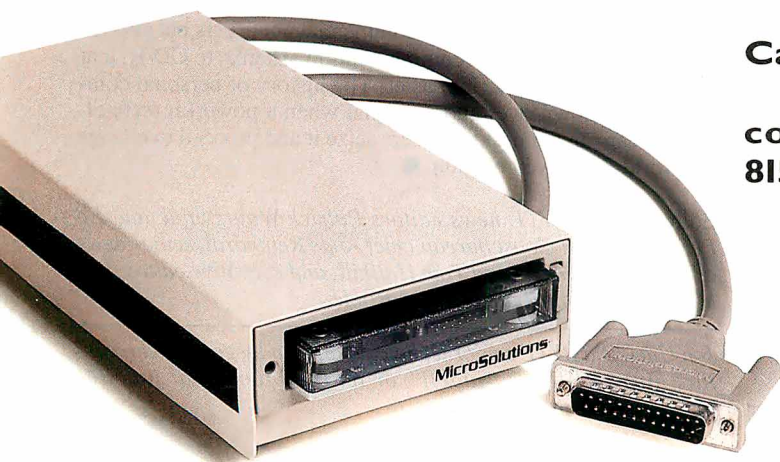
Backpack can backup at a speed of up to 9 MB per minute.

Backpack is a QIC 80 compatible and can read QIC 40 tapes.

Backpack is available in 3.5" and 5.25" diskette, tape and hard disk models.

So don't get left in the dust. Call for more information today.

Micro Solutions, 132 W. Lincoln Hwy., DeKalb, IL 60115, 815-756-3411, FAX: 815-756-2928



backpack

MicroSolutions

Computer Products

Optical Flavors

ANDY REINHARDT

CD-R offers a mix of drawbacks and advantages relative to its optical competitors WORM and MO (magneto-optical). With incremental, file-oriented write capability still on the drawing board for CD-R, it loses out to MO and WORM for interactive on-line use. It also loses out on price, with an average drive costing just under \$10,000. WORM drives average \$3800, while MO drives average roughly \$4500. CD-R's great strength is standardization unmatched by any other form of removable media. Magnetic options such as Bernoulli and Syquest are proprietary, and the WORM market has been plagued by noninterchangeability. CD-R users can rest secure in the knowledge that archived data will be readable on any CD-ROM player.

In the short term, however, it's MO rather than CD-R that is usurping WORM's archival role. Researcher Freeman Associates' (Santa Barbara, CA) vice president Robert Abraham projects that sales of 5¼-inch WORM drives will plunge from 40,000 units this year to almost none in 1997, while

5¼-inch MO drives will grow from 174,000 to 400,000 units over the same period.

Competition for WORM will come from two kinds of "multifunction" MO drives. Hewlett-Packard, Sony, Hitachi, and Maxoptix sell drives that use standard 5¼-inch MO media but allow users to designate certain disks for write-once use only.

Critics charge that by merely emulating WORM, these drives don't offer the same degree of permanence and security as true WORM. Abraham says some people insist on using only ablative media that record permanently. Responding to that need, Pioneer and Laser Magnetic Storage sell drives that accept the same write-once media as their traditional WORM drives and also read and write 5¼-inch MO disks. Abraham says these drives are a good option for users who insist on true WORM but sometimes want the flexibility of rewritable media.

As CD-R drives and media get cheaper, recordable CD technology is likely to capture a growing share of the archival market. Early applications will

have to be batch-oriented, however. "When you write to a CD," says Cris Simpson, an optical memory engineer with Pioneer Communications of America, "you have to lay down a big hunk of data because of the overhead associated with each session." File update capability for CD-R awaits completion, and then widespread acceptance, of the Frankfurt committee's ECMA (European Computer Manufacturers' Association) 168 specification.

Where CD-R is not expected to hurt WORM is in the specialized market for high-capacity storage. The only WORM drives Sony now sells are the 12-inch variety, which offer capacities of 6.5 GB and are often packaged in huge jukeboxes. "CD-R doesn't affect the regular WORM market for us," says Alan Sund, Sony's marketing manager for CD-ROM drives. "It's a totally different product and market, a whole different range of capacity."

Andy Reinhardt is BYTE's West Coast bureau chief. You can reach him on BIX as "areinhardt."

send a tape to your local CD-ROM copy shop and have it make a CD for you. Walnut Creek CD-ROM (Walnut Creek, CA), for example, accepts 8-mm and QIC (quarter-inch cartridge) tapes and charges \$195 for overnight conversion to CD-ROM.

Client-Server CD-ROM

The push for a generic client-server model appropriate for CD-ROM has two motivations. The most critical need is to slow the proliferation of user interfaces that comes with a growing number of titles. My local college library has four CD-ROM stations, each with a different title. Because four different vendors produce those titles, there are four different user interfaces to master.

SFQL (Structured Full-Text Query Language), CD-RDx (CD-ROM Read-Only Data Exchange), and DXS (Data Exchange Standard) are among the proposed standards that promise just such consolidation. The viewing application will play the role of client, issuing requests to a data source that acts like a server. The benefit to users will be enormous. Unfortunately, only a few CD-ROM tool vendors have yet embraced any of the proposals now on the table. Many more, including Dataware and SilverPlatter, use a client-server model internally and are waiting for a clear winner to emerge.

A second reason for the client-server model is the need for

effective remote access to CD-ROM stations. A file-based CD-ROM application usable on a 10-Mbps LAN grinds to a halt when you connect to those files at 2400 bps. A server-based CD-ROM, on the other hand, could communicate effectively with a remote client even over a slow link. I could dial into the CD-ROMs as I dial into my library's Ultrix-based on-line catalog.

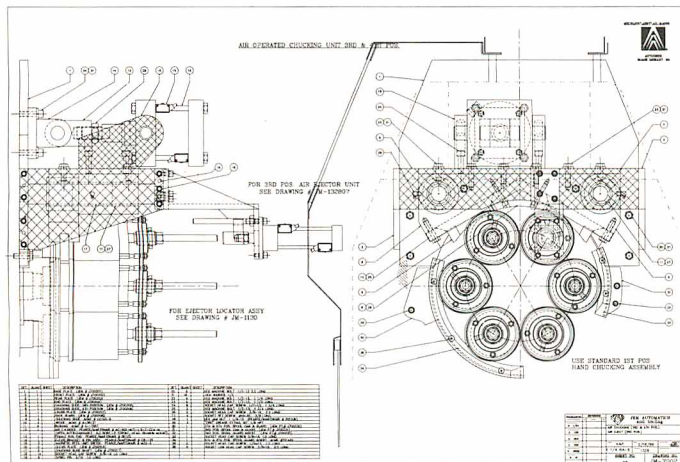
None of these tantalizing future prospects should obscure the central message: Today's CD-ROM, warts and all, is often the medium of choice not only for commercial publishers but also for many forms of corporate communication. Thanks to CD-R, that choice just got a whole lot easier. The history of personal computing has shown over and over that when a powerful technology appears on the desktop, users seize it and proceed to change the world. Here we go again. ■

Editor's note: BYTE news editors Patrick Waurzyniak and Ed Perratore, West Coast bureau chief Andy Reinhardt, senior news editors Gene Smarte and Tom Halfhill, and executive editor Rich Malloy also contributed to this article.

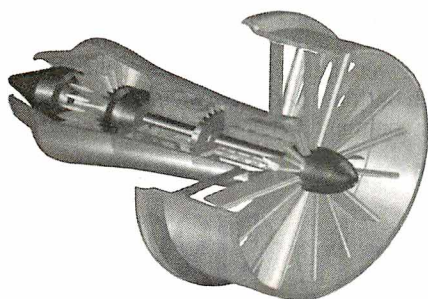
Jon Udell is a BYTE senior technical editor at large. You can contact him on BIX as "judell" or on the Internet at judell@bytelb.byte.com.

ProTracer. Where the qualities of a laser printer meet the output of a large format plotter.

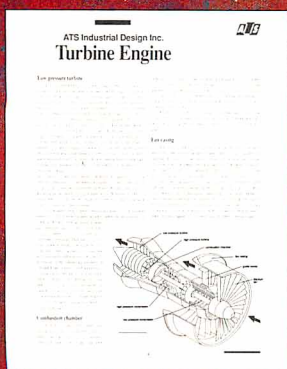
C-size (17" x 22")



B-size (11" x 17")



A-size (8.5" x 11")



Laser printers offer so much.

Like high quality output, speed, desktop convenience and, of course, a low price. Large format plotters, on the other hand, give you the output size you need for certain drawings and applications. What we've done is pulled all of these features together to create ProTracer™ — a personal printer and plotter that produces A, B, and C-size output at an impressive 360 dpi resolution.

FEATURES INCLUDE:

- ▶ High performance Canon® inkjet engine
- ▶ Fast, Intel i960™ processor—drawings that take over one half hour on pen plotters take as little as five minutes on ProTracer!
- ▶ Optional accessories including a new, faster HP-GL® language emulation card, PostScript® language emulation, memory expansion boards, and sheet feeders
- ▶ Full vellum capabilities
- ▶ Unsurpassed customer service — 60-day money back guarantee, one year warranty, and unlimited technical support

ProTracer base unit

- ▶ Customized ADI and PADI drivers for AutoCAD users
- ▶ Epson and ProPrinter emulations

\$1499

ProTracer with HP-GL

- ▶ ProTracer base unit
- ▶ HP-GL emulation card plus memory

\$2249

ProTracer with PostScript emulation

- ▶ ProTracer base unit
- ▶ PostScript language emulation card
- ▶ 8 MB memory

\$2897



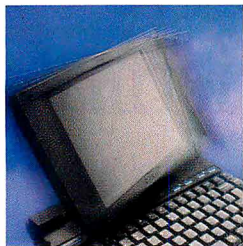
For the bigger picture, call Pacific Data Products at (619) 625-3568, Fax (619) 552-0889.



**PACIFIC DATA
PRODUCTS**

Pacific Data Products, Inc., 9125 Rehco Rd., San Diego, CA 92121. In Europe, call (353) 61 475609. ProTracer is a trademark of Pacific Data Products, Inc. All other brands and product names are trademarks or registered trademarks of their respective manufacturer. Image courtesy of AutoDesk, Inc. ProTracer uses PeerlessPage™, the advanced Imaging Operating System from Peerless. PhoenixPage is a registered trademark of Phoenix Technologies Ltd. © 1992 Pacific Data Products, Inc.

The only notebook with a tilt & swivel display. Great for sharing data or keeping it private. Easily adjusts for perfect viewing.



This fine Italian leather carrying case is an additional option. Loaded with pockets and features everyone will appreciate.



Digital brightness and contrast buttons make screen adjustment so easy.

ZEOS® Freestyle/SL. More features at a lower cost than any other notebook.

To try and compare the new ZEOS Freestyle/SL to any other notebook is next to impossible. Because nothing else has all its features. And even with all these great features, nobody can match the price. Features and price. It would seem the new ZEOS Freestyle/SL is the best of all worlds. It is.

DESIGNED BY USERS. JUST LIKE YOU!

We asked our customers what it is they want in the perfect notebook. The first thing they told us is that most notebooks look like a cigar box with a lid. They told us they wanted not only good looks, but things like great power and great battery life. Lightweight too, like five pounds and change. And the keyboard should be effortless to use. The entire product had to be extremely durable. And that was just for starters.

SL POWER. SL BATTERY LIFE. 64K CACHE!

We listened well.

Then we got down to work. For the chipset and CPU we selected the Intel 25MHz SL. We then built in a high-speed 64K SRAM cache as standard. We know this system might well replace a desktop for many users.

And power to your ZEOS Freestyle/SL system is provided by our advanced battery system. The fully enclosed lightweight battery packs easily snap in and out and can be quick-charged when the system is not being used or trickle-charged when in use. So what happens when the power is on?

GREAT VIDEO TOO.

You get great video! Because for video control, we chose the amazing new Cirrus Logic VGA controller. It not only consumes less power, it also produces the fast crisp images you're looking for. And with a business machine like this you'll also appreciate our dual display capabilities. You can connect an external VGA color monitor for simultaneous display. And that's not all.

Period.

A NOTEBOOK KEYBOARD YOU'RE GOING TO LOVE.

We re-designed and re-sculpted every key from scratch. Even the key-switch mechanism was invented anew. And we added the mouse key for easy cursor control. It is the absolute perfect notebook keyboard. What else?

Lots else! Like the best display system of any notebook available anywhere. We listened here too. The screen is big and easy to read. Plus, it's high contrast and it's fast. It's also very easy to adjust. People said contrast and brightness knobs were hard to use. So we replaced them with soft touch buttons that *electronically* adjust screen settings at your command. Then we really got creative.

THE ONLY NOTEBOOK WITH A TILT & SWIVEL DISPLAY.

Can you imagine your desktop PC without a tilt and swivel display? Neither could we. So why not incorporate that feature into a notebook. With the ZEOS Freestyle/SL notebook you can adjust the screen left and right as well as tilt it up and down. Now you can truly adjust your notebook screen to the perfect viewing angle.

IT FLOATS TOO.

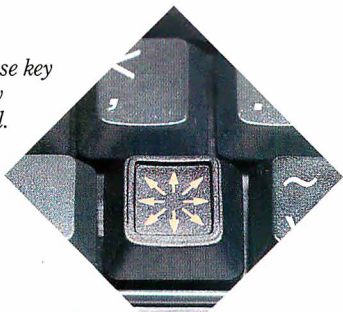
And then there is the "floating" screen. When you're facing your new ZEOS Freestyle/SL, the screen actually appears to "float" in the air in front of you. It's the only notebook that can really be used sitting on your lap!

EXTRA, EXTRA, EXTRAS. READ ALL ABOUT 'EM!

We've made more options available than ever before. Like our modem with send/receive fax. And memory up to 20MB, hard drives to 180MB, even an optional Italian leather carrying case! Extra batteries and a charging stand are available too. Call 800-554-5226 for all the details.

2MB, 60MB Only \$1895!

Built-in mouse key
provides easy
cursor control.
Leave those
bulky mice
behind!



This sliding port door won't
break off or come loose.
Saves your fingers too.



ZEOS. #1 RATED NOTEBOOKS, SERVICE & SUPPORT!

PC Magazine recently surveyed notebook users for their Service and Reliability issue. Their findings? "Only ZEOS portable PCs achieved significantly higher-than-average ratings in all four categories." The categories were reliability, future purchase plans, repair service satisfaction and technical support. And remember, ZEOS technical support is 24 hours a day, 365 days a year, toll free. And we back your new ZEOS Freestyle with our 30-Day Absolute Satisfaction Money-Back Guarantee, One Year Limited Warranty and more.

ORDER YOUR AMAZING ZEOS FREESTYLE/SL NOW.

Ordering your new ZEOS notebook is easy. Simply pick up the phone and give us a call. A friendly ZEOS Systems Consultant is ready to answer any questions you may have. You're going to love your new ZEOS notebook. Give us a call!

CALL NOW TOLL FREE:
800-554-5226

Purchase orders from Fortune 1000 companies, governments and institutions are subject to approval. Leasing programs are available. All prices and specifications are subject to change without notice. Please call to confirm pricing, specifications and warranty details. All products and company names are trademarks or registered trademarks of their respective holders. © 1992, ZEOS International, Ltd., 1301 Industrial Blvd., Minneapolis, MN 55413 USA. ZEOS is a publicly traded company (NASDAQ symbol: ZEOS).

X202-BYT-9302

NEW ZEOS FREESTYLE/SL ONLY \$1895

- Intel 25MHZ 386SL, 64K cache!
- 2MB RAM standard, expandable to 20MB.
- 60MB hard drive, options to 180MB, 3.5" 1.44MB floppy.
- Backlit 9½" VGA display with Tilt/Swivel base. Simultaneous display with external VGA monitor.
- Snap-in and -out battery packs provide for a real 3-4 hours of typical operation or even longer depending on your applications.
- Quick-charge in little over an hour with the small lightweight AC adaptor.
- 8.5" x 11.3", 5.6 pounds, built-in soft carrying handle.
- 81-key keyboard with built-in full-size inverted "T" arrow keys.
- Serial, parallel and VGA ports with standard connectors protected by a durable, easy-to-use sliding door. No more broken doors or broken fingernails!
- 30-Day Money-Back Guarantee One Year Limited Warranty, ZEOS Customer Satisfaction Package.
- Loads of options. Modems, carrying cases and more!
- Designed and built by ZEOS right here in the USA.
- 24-Hour-a-Day Toll-Free Telephone Support, 365 Days a Year.
- Upgrade Packages Too: Call for details about absolutely loaded systems featuring more memory, bigger drives and Windows.

ORDER NOW TOLL FREE:
800-554-5226

Fax Orders: 612-633-1325
Government: 800-245-2449
Hearing Impaired (TDD)
Orders: 800-228-5389
Outside US and Canada:
612-633-6131
MasterCard, Visa, Discover,
Am Exp, Z-CardSM
Open 24 Hours a Day,
365 Days a Year!



"Do Maynard[®]
MaynStream[®] cartridge
tape systems really have
capacities up to 1.3 GB
and transfer data up
to 36 MB per minute?"

"Yes."

"I understand they come
with software that
supports DOS*, Microsoft^{*}
Windows, OS/2*, and
NetWare* NLM*?"

"Yes."

"And for a limited
time you're offering
the high-capacity
MaynStream 1350Q
at up to \$1,000 off
suggested retail price?"

Enough said.

For your free Networking Disaster Prevention
Information Kit or the Maynard dealer
nearest you, call 1 800 821-8782.



Maynard[®]
An ARCHIVE[®] Company



Maynard, a division of Archive Corporation • Marketing Communications • 36 Skyline Drive • Lake Mary, FL 32746 • FAX (407) 263-3638 • (407) 263-3500 (USA) • 44-494-473-434 (UK)
Maynard and MaynStream are registered trademarks of Archive Corporation. All other products herein mentioned are trademarks or registered trademarks of their respective corporations.

Circle 98 on Inquiry Card (RESELLERS: 99).

Is ITV Here to Stay?

ITV brings new information services into your home,
but first it must survive

CARY LU

Interactive TV (ITV) bridges the gulf between your computer and your TV. You can exchange information with a control center through a small computer (known in the trade as a black box) attached to your TV. The control center's computer reacts to your input by changing the image on your TV screen.

You can interact with various services. For example, you could compete against TV game show contestants, request further information about an advertised product, tap into a pay-per-use database of up-to-the-minute financial information, or buy a new computer from a mail-order outlet. ITV systems can give you cost-effective, on-demand news, weather, and financial data (see the screen on page 140).

But ITV's detractors question whether it holds any significance for computer users. Many note that ITV's debut comes on the heels of a long list of failed products in related genres. "We are very interested in being the conduit for whatever services the market will pay for," observes Mike Schwartz, vice president for communications at CableLabs, the cable TV industry's R&D arm, "but a lot of our companies were hurt by the earlier versions of two-way television; people didn't buy them."

ITV's proponents argue that the potential ITV market is far larger than that for similar services delivered to a computer by on-line systems. They are convinced that people don't want to learn how to use a computer, preferring instead the familiarity of a TV. "It's easier for people to relate to their TV than to relate to a computer," asserts Paul Sturiale of TV Answer, a start-up ITV company in Reston, Virginia.

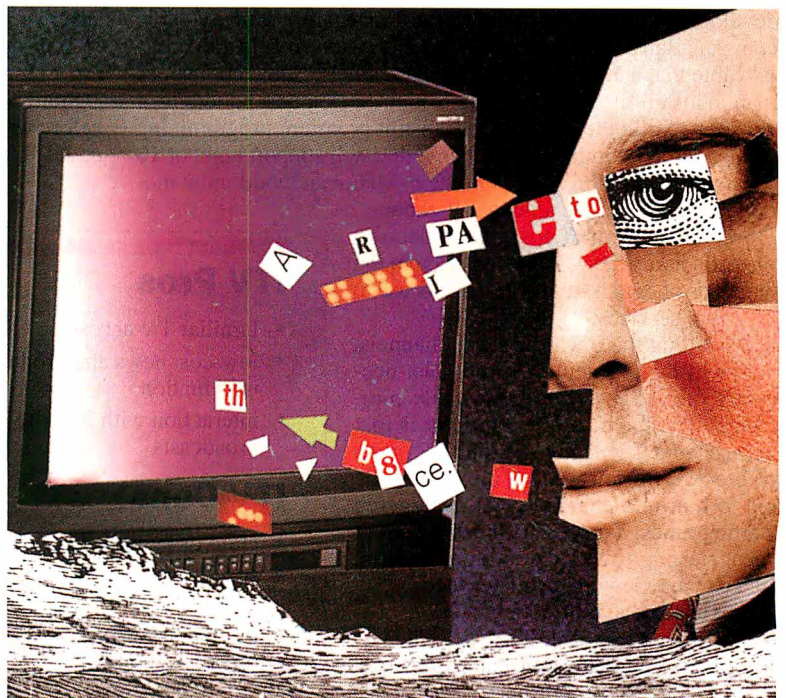
To reinforce their product as a TV add-on, several ITV companies downplay any similarities between their black box and a computer. "Our marketing [department] will never say that it is a computer," says Laurence Kirsch, TV Answer's

director of user-interface design. "The computer in your office you have to use. A TV product you want to use," he adds.

Sending Signals

The first major hurdle ITV system operators must overcome is how to get a signal from their control center to you. Three major distribution methods are available: radio or TV broadcast, cable TV, and modem (see the figure on page 142).

Operators can broadcast their signal at a variety of places in the spectrum: on a subcarrier of an FM radio station, in the black bar between TV frames (known as the vertical-blanking interval, or VBI), or on a specially assigned frequency. The FCC has already allocated the 218- to 219-MHz bandwidth to



ITV, to be split between two services (with 0.5 MHz each) in every city.

FM radio broadcast and VBI techniques generally are limited to 9600 bps for all activities. Because several activities occur simultaneously, the bandwidth is low, and for short bursts, a single activity can take over the entire bandwidth.

Information transmitted via radio and VBI is limited to text, graphics primitives, and information for positioning an object on-screen. With graphics primitives, the outbound ITV signal instructs the black box to place a circle of any size, position, and color on-screen. The black box takes care of the details necessary for generating each pixel of the circle.

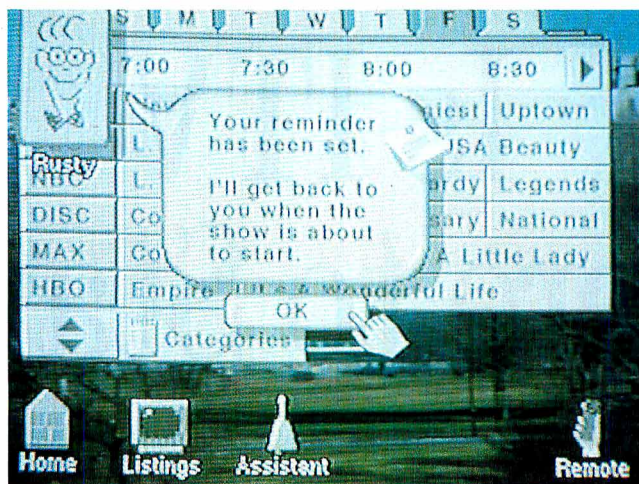
None of the broadcast systems can supply photographic images. Graphics and color are limited to simple objects. This restriction means that if you are shopping for a computer, you cannot browse through pictures of computers.

Most ITV broadcast systems can be distributed through cable TV links. Some ITV operators place the outbound signal in the 4-MHz gap between TV channels 4 and 5. Others dedicate one or two video channels to sending data. An ITV system with its own video channel on a cable system can send photographic images, provided that the black box has sufficient memory to store an image. Full-motion video is technically possible but not practical on a dedicated channel, since everyone using the ITV service would have to watch the same image.

Older cable systems are limited to 36 or fewer channels, so, typically, they can't devote free channels to ITV. However, new developments may change all that. For example, many cable companies are replacing older cable with wider-bandwidth coaxial cable that can support about 150 channels. Some companies plan to install fiber-optic cables, which can support hundreds of channels. Still others expect to transmit premium programming using a digital-compression scheme that will support eight or 10 separate full-motion images in the 6-MHz bandwidth now monopolized by a single analog TV channel. However, the initial cost of the decompression hardware—expected to be in the hundreds of dollars—may restrict its use to premium services.

Assuming there will be extra channels, how will that capacity be used? Not necessarily for ITV, according to cable companies. The most common answer is that extra channels will support multiple feeds of blockbuster movies. A movie will be fed to multiple channels, with staggered starting times. You could choose a convenient starting time, take an intermission, and resume viewing on a later feed.

For interactive full-motion video, the basic architecture of cable TV has to change. Simply adding fiber-optic cables won't be enough; the signal-distribution system has



Using a hand-held controller, you enter instructions into the black box, which exchanges information with the ITV central control computer. Here, the black box has been programmed to signal the start of a TV show. (Photo courtesy of TV Answer)

to switch separate video feeds for each interactive customer. Today, most cable systems feed the same signal to each subscriber. Even fiber-optic cables may not have sufficient bandwidth to support thousands of customers pursuing different activities; therefore, at least part of the cable bandwidth needs to be wired in a style like that of the telephone system, with a separate feed to and from each house.

Telephone-based ITV can take the form of a traditional modem link. Present modem protocols limit speeds to 19.2 Kbps. On a standard twisted pair of copper wires, telephone companies already offer 56-Kbps digital telephone links or a 64- to 128-Kbps ISDN link, but few sites are set up for such services today. The V.Fast protocol standard, which should be nearing completion by the time you

read this, will improve on current modem protocol speeds, but it will not achieve ISDN data transfer rates.

The maximum carrying capacity of twisted-pair cables is much higher, so data rates of more than a megabit per second or a single full-motion-video channel are possible. A video dial tone would let you send instructions as to what you want to see. The images would appear in full motion on your TV screen. When and if fiber-optic cables reach you—either from a cable company or from your local telephone company—multichannel, interactive video will become practical from the technical point of view.

However, fiber-optic cables won't be in place for years because of the high cost and the delays inherent in obtaining approval from public utility commissions. "I would say that it will take five years or so before we start seeing wide-scale deployment of fiber-optic cabling," says Patty Anderson, McGraw-Hill/Data-pro's assistant editor/analyst for Voice Networking Systems in Delran, New Jersey. "It'll be another five or six years after that before we'll see a majority of homes and offices wired for fiber optics," Anderson adds.

Sending Your Signals Back

You send your return signal to the ITV control center by modem or low-power transmitter. Your return signal contains minimal data, usually less than 10 bytes for coding your response and another 10 bytes for an identification code. A hand-held controller serves as your interface with the black box.

Modem links are easy to establish, since every customer has a telephone line. You can have problems, however, if another family member is using the telephone. Low-power transmitters avoid this problem. ITV operators using the 218- to 219-MHz bandwidth expect to set up multiple transmitter/receiver sites in the manner of cellular telephone systems. Thus, the transmitter inside the black box

ITV Pros

- familiar TV access
- low-cost news and product information
- interaction with favorite TV broadcasts

ITV Cons

- child of failed industries
- speed hampered by present technologies
- limited third-party development options

Representative ITV Services

Not all the following companies fit the definition of an ITV service precisely, but they are representative of the services available today or planned for the near future.

- **XPress Information Services** (Denver, CO) has been in operation since 1985 and has 25,000 subscribers. Its outbound signal is 9600 bps, distributed on an FM radio subcarrier, normally through cable TV systems. Its black box converts the XPress feed into a serial-port stream that's fed into your computer. Software on your computer monitors and picks out items of interest to you. XPress is not interactive; there is no return channel.

- **Videoway**, operated by Le Groupe Videotron (Montreal, Quebec, Canada) since 1990, claims 180,000 customers in Canada and 37,000 more in the U.K. It is based on teletext technology, with no interactivity. Besides text, Videoway can distribute personal computer software (currently all games) through a serial port. To overcome the black box's storage limitations, Videoway sends its data-stream and software inventory over and over again. All computer software offerings are repeated every 15 seconds. Popular text pages repeat more frequently. Because such repetitive transmission requires high bandwidth, Videoway assigns two cable TV channels to support a 4-Mbps data transfer rate.

Le Groupe Videotron is planning to introduce a modem return channel that will add interactivity. The company is also planning a new remote control with a miniature keyboard to support short E-mail messages.

- **Interactive Network** (Mountain View, CA) is a start-up operation based in Sacramento and northern California. It produces its own programming, including games and activities that are tied in to TV pro-

gramming. TV tie-ins are undertaken without the support of the TV program producers.

Interactive Network's outbound signal is broadcast on an FM radio subcarrier at 9600 bps. The return path is sent through a 1200-bps modem. Interactive Network also plans to use the 218- to 219-MHz ITV frequency bandwidth.

Unlike with other ITV systems, the Interactive Network display does not appear on your TV screen. Instead, its hand-held control unit has a built-in 8-row by 40-column LCD (240 by 64 pixels). In addition, the control unit contains a miniature keyboard (see the photo).

- **TV Answer** (Reston, VA) successfully petitioned the FCC to assign the 218- to 219-MHz bandwidth to ITV services. A license assignment is under way in major cities, and TV Answer plans to begin operations this summer.

TV Answer's outbound signal (about 12 Kbps) will be broadcast in

a manner resembling that of a cellular telephone. A series of cell sites will broadcast throughout a city, and each cell site will serve up to 64,000 customers. If the number of customers increases, more cells can be set up. The return path will be in the same frequency bandwidth, running at 5000 bps.

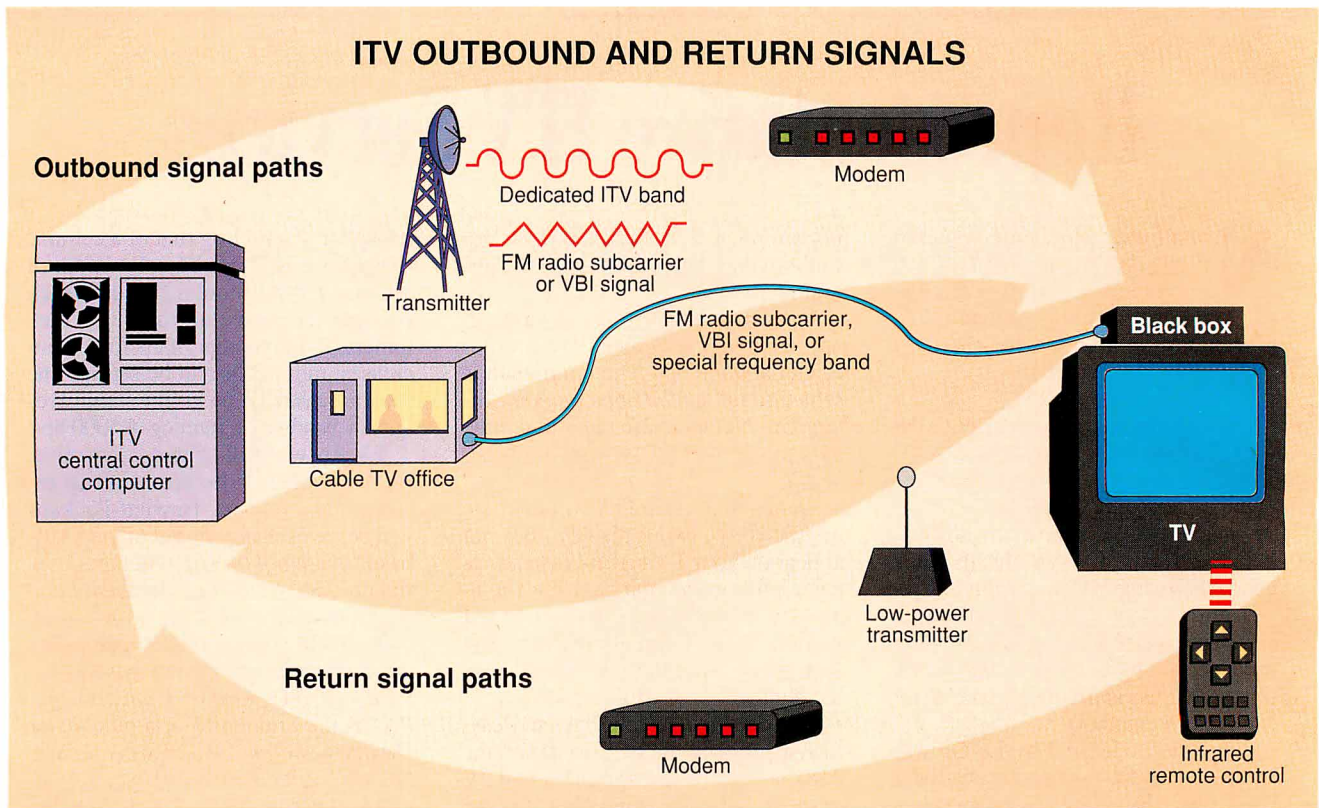
TV Answer will be pure interactive; information will be sent only in response to a request. Hewlett-Packard will be the exclusive maker of the 8088-based black box, which will have a serial port and an optional infrared interface that will exchange information with an HP 95LX palmtop computer, small printers, and other accessories.

- **Television Computer** (Pittsburgh, PA) is the brainchild of a number of Carnegie Mellon University researchers. Still in its planning phase, Television Computer will distribute a 5-Mbps signal through cable TV. Mostly, the service would be one-way, with a modem return channel. The concept is to make its service open for anyone to supply information and develop applications that monitor the data stream, extracting information when appropriate. Plans call for the black box to be fairly powerful, with several megabytes of RAM and a multitasking operating system.

• **The Tandy VIS** system from Tandy (Fort Worth, TX) is a CD-ROM player for your TV, using a modified version of Microsoft Windows. As such, the Tandy VIS is not interactive in the style of other systems described here, but it contains internal expansion slots that will support interactive operation in the future. Its main competitors, the Philips CD-I and the Commodore CDTV/Amiga systems, do not have a path to such interactivity in their current forms.



Unlike with other ITV services, Interactive Network's display appears on the hand-held control unit and not on your TV. The unit has an 8-row by 40-column LCD and a miniature keyboard. (Photo courtesy of Interactive Network)



The ITV central control computer transmits signals by FM radio subcarrier or TV broadcast, cable TV, or modem. Your return signals are transmitted via a modem or a low-power transmitter. A black box attached to your TV decodes and encodes signals, and you can program it to scan and store specific information and broadcasts via a hand-held controller.

would need only a few watts of power.

With either method, it takes 5 to 10 seconds to establish a connection and get a screen response. Often, the software inside your black box can supply the necessary interaction, speeding its response time.

In principle, two-way cable systems can support higher-bandwidth return channels and faster response times. But two-way cable is used mainly to support relatively simple features, such as pay-per-view. As with a radio return path, a cable return path eliminates any problems that you might have with someone else using your telephone line.

Information Publishing and Fees

All ITV systems have a gateway at the control center that formats information for distribution. The system operator acts as publisher and decides what information is sent to you. The information can be sent to all customers, to some customers, or just to you.

An ITV operator transmitting at 9600 bps sends out some 90 MB of data each day. This is equivalent to 90 big city newspapers arriving on your doorstep. You can program your black box to continually scan this data and pick out only what interests you. Some ITV systems let you program your black box to switch on your VCR and record this specialized data.

Pure interactive systems only send information on demand. If you do not request information or an interactive feature, nothing is sent, aside from occasional software updates for the black box or program guides.

Other systems mix interactivity with data broadcasting. In this scheme, when the bandwidth isn't needed for interactive information, the system transmits an endless stream of data, such as a

delayed stock market ticker, news wires, text from magazines, and so on.

Having both pure interactive systems and broadcast models leads to two different ways to charge for services. Pure interactive systems keep track of every request you make and then charge for each transaction. You, an information provider, or an advertiser might pay that fee, and there may not be a subscription fee. Broadcast ITV systems generally have subscription fees, typically ranging from \$15 to \$20 per month. A broadcast system can also charge for interactive activity. Almost all systems levy a service fee when you purchase something, and interactive games may have special fees tacked on to the regular charges. For example, Interactive Network (Mountain View, CA) charges \$15 per month for basic services and \$20 per month for special activities. Besides transaction or subscription fees, most operators charge \$200 to \$700 for the black box.

Services Are Familiar

Today's ITV operators offer services such as news, weather forecasts, and community BBSes, all of which are familiar to users of services like BIX and Prodigy. Electronic messaging and banking are possible, but at present they are a low priority for most ITV operators.

Many ITV operators offer locally originated and distributed information as well as a nationwide signal. For example, an office-supply shop may want to sell only in its delivery area. Such localized content is possible if the system knows the location of each customer. All systems can localize to some extent, and some can position users down to a city block.

Most ITV systems are not open to customer-supplied

The death Has been greatly exaggerated of DOS

DOS is still the preferred operating system on over 80% of the PCs in Fortune 1,000 companies, according to recent studies.

Bring Windowing Advantages to DOS.

Many Fortune 1,000 companies are using DESQview™ as the best solution for keeping the dependability and familiarity of DOS programs and adding multi-tasking, windowing productivity. DESQview users give up nothing—since it actually runs MS Windows better

should users wish to run Windows programs.

As you may know, DESQview 386 has been around for years, evolving into a highly efficient multitasking, windowing environment that extends the power of DOS, giving you increased productivity while conserving precious memory and disk space. In fact, the vast majority of 386 and 486 PCs need no additional memory or disk space to run DESQview.

DESQview 386 gives you pre-emptive multitasking like OS/2, but with 1/4th of the disk space and 1/4th of the memory requirements. It gives you windowing like MS Windows, but with greater speed and efficiency and fewer 'crashes.' And DESQview lets you use a mouse or stick to the keyboard.

You Create the Standards; We Follow.

We've never been confused about our role. We believe software companies exist to make your job easier and your working day more productive. When publishers step out of that mold and begin to tell you what hardware you need and that you should throw out



DESQview adds multi-windowing, multitasking productivity to DOS

somebody else's perfectly good software—well, they simply are not operating in your best interest.

Software publishers don't create standards. You do. And whatever standard you choose, we support it.

If you like a program that only runs in MS Windows, like Wordperfect for Windows, DESQview 386 supports your choice. If you prefer a spreadsheet that runs in DOS, Lotus 1-2-3 Release 3, for example, we support that too. In fact, DESQview 386 lets you run

your favorite DOS and Windows programs side-by-side.

Have Your Cake and Eat It, Too.

DESQview 386 comes with QEMM-386, the number one memory management utility, and Quarterdeck Manifest, the award-winning memory analysis and monitoring program. Between them, they assure you every last 'K' of memory is put to use*. In many cases, QEMM can mean the difference between running the TSRs you want and not having enough memory.

And DESQview is an open doorway to the future, too. Our next step up, DESQview/X, opens your PC to a network full of possibilities, including graphic workstation standards—X Window System software—all while retaining the compatibility of DESQview.

If you're as committed to DOS as we are, and feeling left out by the so-called industry leaders, take heart. There's no reason to leave DOS. If more productivity is what you need, we can provide it.

Quarterdeck helps you get the most out of the hardware and software you own today.

Quarterdeck

Quarterdeck Office Systems, 150 Pico Boulevard, Santa Monica, CA 90405 (310) 392-9851 Fax (310) 314-4219
Quarterdeck International Ltd., B.I.M. House, Crofton Terrace, Dun Laoghaire Co. Dublin, Ireland Tel. (353) (1) 284-1444 Fax: (353) (1) 284-4380

* DESQview makes multitasking and windowing available to users of 286-class machines with similar memory efficiencies through QEMM-50/60 for IBM™ PS/® 50 and 60 users and QRAM for other 286 users.
©1992 Quarterdeck Office Systems. Trademarks are property of their respective owners.



PRODUCT AND TECHNOLOGY CONSULTING, RESEARCH AND ANALYSIS

DATAPRO ASSIST ON DEMAND

- QUALITY ANSWERS
- QUICK RESPONSE
- LOW COST
- AVAILABLE ON A
PER PROJECT BASIS

Datapro Assist on Demand is the new consulting service from Datapro that can provide you with the answers you need to make fast, accurate decisions. *Datapro Assist on Demand* delivers authoritative and comprehensive information on computer and communications technology. You pay for only the information you need. No exorbitant consulting fees. No ongoing commitments.

Datapro Assist on Demand puts you in touch with a Datapro analyst. With one quick phone call, you'll soon have all the information and analysis you require, without the effort and bother involved in researching the problem yourself or contracting with an expensive consulting firm.

You can trust *Datapro Assist on Demand* to provide you with objective facts and analysis custom-tailored to your specific requirements.

**TO LEARN MORE
ABOUT DATAPRO
ASSIST ON DEMAND,
CALL US TODAY AT
800-328-2776, EXT. 2777,
OR SEND US A FAX
AT 609-764-2812**

DATAPRO

600 Delran Parkway, Delran, NJ 08075



Discover the best systems in the industrialized world.

The industrial sector is no place for weak technology. And one industrial line has more depth and experience than any other. To get free, detailed product analyses just return this card, fax it to 1-713-933-1029, or call 1-800-627-8700!

I PURCHASE COMPUTERS FOR:

☐ Internal company use ☐ Resale ☐ Both

SOLUTIONS I PROVIDE: _____

APPLICATIONS I AM RUNNING: _____

PROCESSOR: ☐ 386 ☐ 486 ☐ Other _____

CONFIGURATION: ☐ Rackmount ☐ Bench/desktop
☐ Tower ☐ Industrial workstation ☐ Cards

ENVIRONMENTAL SPECS: ☐ Heat ☐ Dust ☐ Shock
☐ Vibration ☐ Fault tolerant ☐ Other _____

TENTATIVE PURCHASE TIME FRAME: ☐ One month
☐ Three months ☐ Six months ☐ Over six months

NAME _____

TITLE _____

COMPANY _____

PHONE _____

ADDRESS _____

CITY _____

STATE _____ ZIP _____

† European inquiries call 31 36 536 5595. Other international inquiries call 1-713-933-8050.



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST-CLASS MAIL

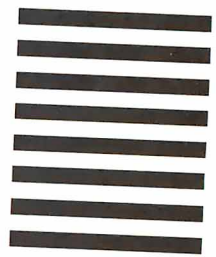
PERMIT NO. 2484

HOUSTON, TX

POSTAGE WILL BE PAID BY ADDRESSEE



TEXAS MICRO
10618 ROCKLEY RD.
HOUSTON, TX 77099-9986



IS ITV HERE TO STAY?

messages for either computer conferencing or E-mail. One reason for this is that your hand-held controller generally lacks a keyboard, so you have to "type" by selecting letters on your screen with a joystick or arrow keys. Also, such relatively complex actions clash with the philosophy underlying ITV: The main services should be easy and entertaining, just like TV.

Black-Box Programming

Can independent software developers write programs for the black box? It's too soon to tell. Today's ITV systems are closed; the system operator controls the software. Every operator encrypts signals and uses passwords. While some ITV operators have indicated that they may distribute independently developed software, how this would be arranged isn't clear yet.

Also, most black boxes accept only software that the ITV operator distributes. They lack disk drives, cartridge slots, or other access to the processor. Consequently, independents cannot make their own black box without approval from an ITV operator. Some of the approved black-box manufacturers include heavyweights such as HP and Zenith Electronics.

Will ITV Survive?

The history of interactive services is marked by failure. In the 1970s, Warner-Amex Cable's Qube interactive cable service flopped. In the 1980s, teletext and videotext services were introduced. Teletext offered news and other information through a VBI signal on broadcast TV. Videotext offered interactive data through a telephone line, complete with graphics and color. Several multimillion-dollar efforts failed (e.g., Knight-Ridder's Viewtron videotext experiment in Florida). A handful of teletext-style services are still available on some cable systems, and the Canadian Videoway service is modeled after teletext technology (see the text box "Representative ITV Services" on page 141). Prodigy keeps the videotext concept alive.

In spite of this checkered past, ITV proponents insist that their time has come. Things are different today, says Richard Cassam, head of new market development for Tandem Computers (Cupertino, CA), a member of the First Cities, which is a 13-company project aimed at eliminating the technical barriers to the delivery of interactive multimedia products. Cassam cites a shift in technology and market acceptance. "More and more things in your daily life mix media," he says. Cassam gives as examples Apple's QuickTime movie standard, picture-in-picture TVs, videophones, and smartphones.

Yet when you consider the history of related services and the technical developments required to bring ITV into the mass market, it's easy to predict that ITV will go bust. "At the very best, there will be a two- or three-year shake-out, lasting through 1996," says Gary Arlen, president of Arlen Communications (Bethesda, MD), a research company specializing in interactive media.

Arlen predicts that major entertainment and information providers, such as computer game companies (e.g., Sierra Online) and publishers (e.g., McGraw-Hill), will stay on the sidelines until after the shake-out. "Then you get into a period of serious competitive marketing," Arlen says.

Others just don't know. "It's either going to be boom or bust," says Laurie Frick, HP's product manager for TV Answer's hardware. "In five years, we will be in way over 5 million households—or way under." ■

Cary Lu has worked for Children's Television Workshop and the Nova series of science documentaries and as an animation producer. He is author of The Apple Macintosh Book (Microsoft Press, 1992). You can reach him on BIX c/o "editors."

The league's toughest expansion team.



Introducing a full range of rugged slot solutions.

When it comes to PC expansion, Texas Micro offers the best computer systems in the field.

We now offer systems that have 5, 10, 14 or 20 ISA or EISA slots. So there's a system for applications with space restrictions, such as embedded control, all the way up to applications that require numerous peripherals and option boards.



These chassis are not only ruggedized for industrial environments, but they have passive backplanes to make option board and CPU upgrades easy. Desktop, tower and rackmount configurations are available. And each is competitively priced.

So call today for price and specification literature. And find out what makes Texas Micro so hard to beat.



Call 1-800-627-8700.

©1993 Texas Micro, Inc. The Intel Inside logo is a registered trademark of Intel Corporation.



WIRELESS MOBILE COMMUNICATIONS

The infrastructure for ubiquitous
wireless data communications is rapidly expanding

JOHN P. MELLO JR. AND PETER WAYNER

In the early days of personal computing, data communications via modems was a black art that was best left to experts. But as the demand for services such as E-mail, file transfer, database access, and remote log-in grew, so did the size, number, and types of data communications services. Accessing them became easier, too. Not surprisingly, the same proliferation of services is taking place in the world of wireless data communications.

Wireless data communications is still principally the domain of large companies with specialized needs, such as a delivery service that must keep track of trucks and packages or a large sales organization that needs to stay in touch with a mobile sales force. This situation is about to change: Within three years, wireless data communications will be as commonplace as wired data communications is today.

Why Wireless?

Two forces are at work to make wireless data communications one of the most important technologies of the next decade. The first is the trend to untether computers from the desktop. With every improvement in integration, miniaturization, and battery technology, the difference between the performance of desktop computers and portables shrinks, as does the premium you pay for portability.

The second force driving wireless data communications is the desire for universal connectivity. Computers and their users are more productive when they have access to external data. The explosive growth in LAN installations over the past five years is ample evidence of the importance placed on connectivity by the business world. Normally, the forces of portability and connectivity are at odds, but wireless data communications lets you have the best of both worlds—freedom from the desktop *and* connectivity.

Wireless Highways

Despite the narrow focus of current wireless applications, a wide range of wireless transmission media are available. With wireless networks expanding to target general computer users

with services such as E-mail, access to standard information services, and support for remote sessions on host computers, you can expect the range of options to grow even more.

The market is made up primarily of RF packet-switched services and cellular phone companies, but this will change as the FCC recognizes the needs of mobile computer users and allocates larger sections of the radio spectrum to what it calls PCSes, or personal communication services (see the text box "PCS and You" on page 148).

Although wireless data communications offers the advantage of not being wirebound, it has its disadvantages as well. First, the radio spectrum is often noisy and prone to losing bits. Losing a few bits for each hundred or thousand that are transferred is not noticeable during a telephone conversation or while listening to a radio program, but it's disastrous during data transfers. Second, the cost of wireless data communications is higher than that of wired communications in the initial outlay for equipment and in the cost of using the services. For example, with a cellular modem, you have to pay for the cellular service that connects you to the phone system and reckon with the standard telecommunications charges from, say, BT Tymnet or MCI Mail (see figure 1).

Advanced digital technology, error-correcting codes, and compression algorithms are beginning to provide robust

Wireless Mobile Communications

BY JOHN P. MELLO JR. AND PETER WAYNER
146

Stretching the Ether

BY PETER WAYNER
159

Communications Get Personal

BY BOB RYAN
169

Resource Guide: PLUGGING INTO WIRELESS

177



PCS and You

Although the cellular communications' infrastructure offers advantages, new wireless communications companies and services are springing up. Recently, the FCC proposed allocating three new 30-MHz blocks of the radio spectrum for organizations developing PCSes (personal communication services) that can include both data and voice transmissions. The FCC has placed no restrictions on the use of this part of the spectrum, and it's actively encouraging companies to come up with new and better services.

American Personal Communications (Washington, DC), Cox Enterprises (Atlanta, GA), and Omnipoint Communications (Colorado Springs,

CO) have been tentatively granted pioneer status for their work in PCSes, which could eventually help them get a license for part of the spectrum. APC intends to offer digital voice and digital data transmissions over this part of the spectrum. And Cox has plans to provide links with cable TV so that people can offer feedback on TV programs.

The PCS area of the spectrum is undeveloped, and it will be some time before companies begin to market services that use these bands. This area, however, offers the greatest hope for innovative, interactive networks. Only time will tell whether those in the industry have the imagination and the capital to find markets for their PCSes.

solutions to many of the noise problems, and competition and the economies of scale should help bring down costs. For the foreseeable future, however, you should expect to pay a premium for wireless connectivity.

The wireless data communications infrastructure consists of many technologies. Most require that you subscribe to a service offered by a centralized provider. But the FCC is investigating plans to reserve more of the broadcast spectrum for unlicensed data transmission (see the text box "Broadcasting Without a License" on page 150).

You can categorize centralized systems as either one-way or two-way. One-way systems (e.g., pagers) broadcast data to a mobile platform and are ideal for many vertical applications (see the text box "One-Way Transmissions" on page 152). Most general computer users, however, need the type of two-way connectivity provided by wired connections.

Today, such users have several alternatives. They can connect a cellular modem to the existing AMPS (Advanced Mobile Phone System) infrastructure—commonly called cellular—which operates in the 825- to 890-MHz bandwidth, or subscribe to one of two RF systems, which operate in the 900-MHz range.

On the Radio

RF systems send data in packets that range in size from 240 to 500 bytes, which is a

method that is less susceptible to adverse conditions than continuous cellular transmission. One of the first packet-switched two-way products available to the general public was the Mobidem modem, made by Ericsson GE Mobile Communications (Paramus, NJ). The company now sells the modem bundled with an HP 95LX computer and a subscription to RadioMail's gateway to the Internet. The modem measures 8 by 3 by 1.3 inches and weighs about a pound (see the photo). It's heavier than one-way receivers, which weigh 2 or 3 ounces, because the circuitry must supply the power to send a signal back to the base station. The Mobidem/HP 95LX/RadioMail bundle costs \$1995.

In addition to the Internet gateway, Ra-

dioMail (formerly Anterior Technology, Menlo Park, CA) provides a number of gateways between the wireless and the wired worlds. It provides the "glue," for example, that makes it possible for you to send a message to an MCI Mail or GENie subscriber from a Mobidem-equipped machine.

The Mobidem communicates over the RAM Mobile Data wireless network (RAM Mobile Data, Woodbridge, NJ). RAM Mobile Data has put up antennas in many East Coast cities and has plans to cover the 100 largest metropolitan areas in the U.S. This year, the company expects to cover about 90 percent of the U.S. industrial population in its service area. The company also plans to saturate the transportation corridors between Boston and Washington, D.C., and between San Francisco and San Diego so that customers driving along the rural stretches of I-95 or I-5 will be able to get their E-mail.

The RAM Mobile Data network uses the Mobitex packet-switching technology, which like cellular technology can hand off communications to other transmitters. Mobitex networks operate in the U.S., Canada, the U.K., Sweden, Norway, and Finland, with others to follow in other European countries and Australia. The RAM mobile Data network can accommodate 16 million unique addressees, with 3 million of these allocated to Canada's Cantel network to permit cross-border communications.

A similar system of city-based radio towers is operated by Ardis (Lincolnshire, IL), a partnership between IBM and Motorola. Originally set up as a network for IBM service technicians, the Ardis wireless network reaches over 8000 cities and towns throughout the country. The company sells its services only to large OEMs and corporate information services. For example, Otis Elevator funnels its service calls to its headquarters in Hartford, Connecticut. The calls are then forwarded to the Ardis network and broadcast to service

PAYING FOR WIRELESS

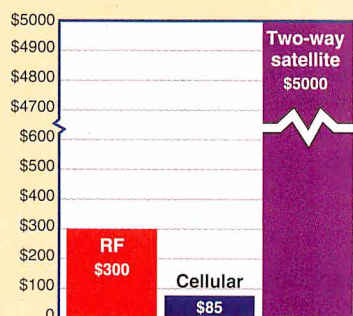


Figure 1: The premium you pay to transmit 500 KB of data using wireless communications differs depending on the medium you use. The packet-switched radio data is for the RAM Mobile Data network, and the satellite data is for Inmarsat. The cellular data assumes 2400-bps throughput and a \$50-per-month access fee. Capital costs, which are not included in the figure, run about \$1500 for packet-switched radio communications, \$1000 for cellular communications, and \$10,000 for satellite service.

technicians in the field.

The Ardis network also enables Avis to process a customer's car request in the time it takes the customer to take the Avis bus from the airport to the company's car lot. According to Robert B. Euler, vice president of marketing for Ardis, a unique feature of the network is its reliable in-building communications capability, which is important in metropolitan areas.

Packet-switched radio communications are expensive. For instance, a basic subscription to the RAM Mobile Data network costs \$89 per month, which includes 100 50-word units. Additional 50-word units cost 29 cents each. This is on top of any fees charged by E-mail or gateway providers, such as AT&T Mail, which will provide a connection to the RAM Mobile Data network this year.

Another drawback to packet-switched radio communications is the incompatibility of modems used by the different services: The Ericsson GE Mobidem works only with the RAM Mobile Data network, and the Motorola RPM 840 is compatible only with the Ardis network. However, the Motorola Infotac modem, which works with off-the-shelf software, will be compatible with both systems.

In the Wings

Last summer, the FCC gave the nod to Mobile Telecommunication Technologies (Jackson, MS) to build the third nationwide wireless data network. The proposed network would run in a 50-kHz block of the 931-MHz band and simulcast data at 24,000 bps (Ardis is just now implementing speeds of 19,700 bps on its system).

According to Mtel, its network will achieve the high data transfer rates by enhancing a technology called MCM (multicarrier modulation). In conventional paging, a baud is equal to a bit, but with MCM, a baud is 8 bits. Thus, Mtel can get higher data throughput for a given data transfer rate.

That's important because of the trade-off between simulcast's superior area coverage and its slow data transfer rates. MCM provides for high-speed simulcasting. Donald Warfield, vice president for strategic marketing for SkyTel, which is also owned by Mtel, says that simulcast is more reliable for building penetration and provides seamless coverage throughout an area.

Mtel's plans for its nationwide wireless network are ambitious. Among the services it expects to provide are acknowledgment paging with prestored messages using conventional pagers, two-way data messaging with palm-size computers or PCMCIA cards, fixed-location data distribution (e.g., point-of-sale terminals), re-



The 1-pound Mobidem provides connectivity within the service area of the RAM Mobile Data network.

mote data collection, information services, E-mail services, industrial remote control (e.g., monitoring alarms and reporting stolen vehicles), and integration with mobile satellite services to provide seamless network coverage. Mtel expects the network to be operational 12 to 18 months from the time the company receives approval from the FCC, which could come this year.

Cellular Connections

Although they rely on a less-robust analog technology, the cellular phone companies have a number of structural advantages over the data-only networks (e.g., RAM Mobile Data and Ardis)—the most important being the installed base of cellular transmitters. Nearly all U.S. cities have two or more competing cellular phone systems. And most important, cellular phone hardware is relatively inexpensive: about \$100 per phone in wholesale amounts. These phones need just a modem and an adapter to start transmitting data. You can buy a mobile phone/modem combination for the average laptop for less than you

would pay for a Mobidem.

Many companies produce cellular modems and adapters that can be plugged into cellular phones. For example, Microcom (Norwood, MA) recently began shipping the MicroPorte 4232bis with fax modem. This portable modem comes with MNP 10, a protocol designed to work in the sketchy world of cellular communications. Zyxel USA (Anaheim, CA) is another company that is making a push in the cellular modem market. Like Microcom, it has included a number of features with its modems to improve the reliability of cellular data transmission.

The MicroPorte and other cellular modems don't require special equipment from the cellular communications provider, although the MicroPorte must be connected to another MNP 10-capable modem to use MNP 10. In addition, regular modems require an adapter to simulate central-switching functions that a modem expects (e.g., a dial tone).

Special protocols like MNP 10 are needed because, unlike their wirebound kin, cellular modems must deal with an adverse environment. For instance, when you place a cellular call, a signal is sent to a transmission tower. Each tower covers a cell about 8 miles in diameter. When you travel from one cell to another, your signal must be handed off to the next cell. When this happens, there's a break in the signal, lasting from a few hundred milliseconds to over a second. It's enough to give conventional modems fits, because they depend on continuous signals. Cellular modems, on the other hand, are designed to operate in this flaky environment. They perform error correction and data compression, increase or decrease transmission speed, change packet sizes, and counteract fluctuating signals.

Cellular modems are also expensive, due primarily to the robust error checking they require and the fact that the market for them is smaller than the market for conventional modems. Cellular modems can cost as much as \$1500, and then there's the cost of the phone calls. With a subscription to a cellular carrier costing \$40 a month and calls costing 60 cents a minute during prime time, you can run up a hefty phone bill in no time.

Packet-Switched Cellular

Because data transmission over cellular voice lines consumes a lot of the voice bandwidth in a cell, cellular companies are constantly investigating other methods of sending digital information over cellular lines. One strategy using analog cellular transmission for data communications is CDPD (cellular digital packet

Wireless Data Communications

- paging and messaging
- E-mail
- file transfer
- anywhere-anytime connectivity

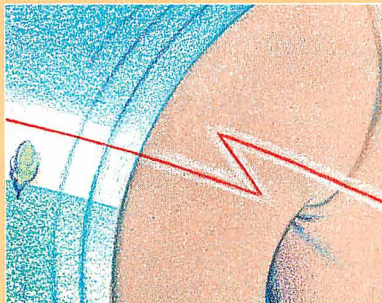
Broadcasting Without a License

Most wireless services require that you subscribe to a central service run by a licensed company. These companies manage their radio spectrum and charge for every byte going through their gateways.

The FCC is marking off a portion of the spectrum for unlicensed, low-power use for mobile computers. These bands will let you set up wireless networks within a building so that laptops and other computers can be moved from desk to conference room and still maintain links with the network.

The FCC proposes to set aside 20 MHz of bandwidth (1×10 -MHz channel, 4×1.25 -MHz channels, and 50×100 -KHz channels) for unlicensed service in response to a request from Apple Computer. The power limitations should prevent a signal from propagating beyond the floor of a standard office building.

Naturally, these systems could lead to chaos if everyone started transmitting in such a narrow part of the spectrum. In fact, carriers like the RAM Mobile



Data network and the cellular telephone companies are counting on this chaos to drive customers to their proprietary networks, where they provide management. The unlicensed bands, however, don't need to be Babel-like. It's possible to create standards for these bands that will be strong enough to maintain order within the band.

The WINForum (Wireless Information Networks Forum) is an industry group based in Arlington, Virginia, that designs protocols for unlicensed networks. It's determining what power levels should be used by the devices and how long the devices should be lis-

tening for free air time before broadcasting.

The final WINForum model may be similar to the Ethernet standard, which requires each computer to "listen" for a random amount of time before sending a packet. The group was to release a suggested etiquette for using the spectrum by the end of 1992, and devices using this part of the spectrum could arrive by 1994. The FCC must approve the plan before manufacturers can ship these products.

Most manufacturers and the WINForum believe that the 20-MHz block of the spectrum (1910 to 1930 MHz) proposed to be allocated to unlicensed systems is hopelessly inadequate for the demand. They expect such devices to find widespread acceptance. When that happens, they hope the FCC will realize that this technology is the best way to provide short-range wireless service to the country. Benn Kobb, president of the WINForum, says, "The radio spectrum is public property. Citizens, schools, and businesses need to have access to it."

data), a technology for transmitting data over unused cellular channels based on IBM's CellPlan II technology.

CDPD offers high bandwidth (about 19Kbps with compression) and continuous connections to networks like the IBM data network. IBM, for instance, will offer 3270 emulation over the airwaves. And CDPD systems can offer more than the store-and-forward E-mail systems, because the high bandwidth makes it easy to run a remote session from a ski lift or a dive shack.

In conjunction with IBM, nine of the country's 10 largest cellular companies are testing CDPD in the San Francisco Bay area. The availability of CDPD in the future will depend on whether your local cellular telephone company decides to install the necessary hardware. The cost for a mobile phone/modem combination for a laptop will be from \$200 to \$400, with the cost of monthly service varying from carrier to carrier. Rob Mechaley, vice president of technology for McCaw Cellular (Seattle, WA), says that his company is

looking at options that will provide basic CDPD service for \$35 to \$50 a month.

CDPD uses a full voice channel—all 30 KHz. CDPD hops from channel to channel to avoid interference with voice transmission. Even in heavy traffic, there's excess capacity that can be used for data. For example, a guard-timing interval between voice assignments can last as long as 10 seconds. "You can transmit a tremendous amount of data in 10 seconds," says Joe Grlica, director of business development at Bell Atlantic Mobile Systems (Philadelphia, PA).

According to Brandon Nixon, product-line manager for CDPD at Pacific Communications Sciences (San Diego, CA), a final specification for the technology was expected to be published by the end of 1992, and hardware for it should start appearing by mid-1993. But skeptics say that time frame is too optimistic.

"They've got a lot of work to do," says James Hobbs, vice president of BellSouth Mobile Systems (Atlanta, GA), which has a stake in RAM Mobile Data. "I do not

think it will be deployed for another four years." Hobbs believes that CDPD was announced early to preempt the development and implementation of competing technologies.

Living in the Shadows

Cellular Data, Inc., (Palo Alto, CA) offers a system that provides data communications over cellular telephone systems. In the cellular system, voice frequencies are separated by 3-kHz frequencies called *guardbands*, which prevent voice calls from interfering with each other. CDI's system uses the guardbands for data communications.

The company acknowledges that its system will not have the same capacity or bandwidth as the CDPD approach, but because it requires less power, the transceivers can be smaller and have less battery power. CDI hopes to attract customers who need services such as electronic messaging but don't need to run remote sessions with host computers over the air. Because the parts of the radio spectrum

NOW THERE'S A WHOLE NEW WAY TO GET ENERGY OUT OF THIN AIR. THE 20 HOUR LAPTOP BATTERY FROM AER ENERGY.



This may come as a bit of a shock, but our new rechargeable zinc-air computer battery runs on air. Introducing the AER Energy™ Power 20™ Rechargeable Battery System. Through patented design, AER Energy's stand-alone battery system uses

oxygen from the atmosphere to generate electricity. Enough electricity to give a portable computer 20* hours of run time between charges.

Three Times The Energy Of NiCd.

This amazing ability to run on air also gives the Power 20 battery an extremely high energy density, which means more energy per pound. In fact, tests prove it produces an incredible three times the energy by weight of conventional nickel-cadmium



batteries. All of which explains how our Power 20 12-volt accessory battery can increase a laptop's run time to an unprecedented 20 hours on a single charge.

More Portable Computing. Our dramatic improvement in energy per pound also improves

portability. You can forget about the hassles of carrying a charger and multiple battery packs, the memory effect of NiCds, or worrying about where and when to recharge. Plus, our battery system allows you to simultaneously power your computer and handheld cellular phone. So see why there's so much electricity in the air. For more information call 1-800-Power 20 (1-800-769-3720).



*20 hours of run time is the average for all computers tested. Actual results will depend upon the computer being powered and the application in use. ©1993 AER Energy Resources, Inc. AER Energy™ and Power 20™ are trademarks of AER Energy Resources, Inc.

Circle 164 on Inquiry Card.

One-Way Transmissions

The original mobile data communication system was the pager, which lets you receive data transmitted from a central antenna over a wide area. Pager technology has improved dramatically, and the best modern pagers can receive and display a stream of alphanumeric characters.

SkyTel (Washington, DC) is the nation's largest paging and messaging service, with 188,500 subscribers. One advantage SkyTel has over most two-way systems is its range of coverage. Using the Westar IV communications satellite, messages are beamed to hundreds of ground stations simultaneously. "SkyTel blankets North America," a company representative explained, "so I could reach you with your pager or palmtop far more easily than I could track you down with a cellular phone."

SkyTel also has links to the major E-mail systems. When you receive an E-mail message, you receive either an alert or the first 240 characters of the message. You can access the full message from a wired system.

Boynton Beach, Florida-based EMBARC/Motorola's EMBARC (Electronic Mail Broadcast to a Roaming Computer) system is smaller than SkyTel, although it was scheduled to be in 220 cities and reach 90 percent of the U.S. industrial population by the end of 1992 (see figure A). Its messages, however, are bigger (up to 1500 characters) than SkyTel's. In addition, the EMBARC system transmits 8-bit data, so binary files can be moved on the sys-

tem. SkyTel transmits only 7-bit data.

EMBARC/Motorola implemented a messaging switch based on the X.400 standard, which opens its system to a wide range of E-mail systems. You can tag a message you have received and write a response. The next time you're connected to a modem, select the EMBARC option in your E-mail package, and the EMBARC system automatically logs you onto the switch and sends your response to the sender via the X.400 gateway.

Brad Davis, director of strategic marketing at EMBARC/Motorola, says his company's system offers another advantage. "A broadcast fax has an incremental cost per recipient," he says. "With EMBARC, you can send a message to 1000 people at the same price it costs to send it to just one."

The EMBARC system uses Motorola's NewsStream receivers, which cost \$395. Motorola has announced a PCMCIA-2 version of the NewsStream that will have a larger internal memory (128 KB) and fit inside laptops. According to the announcement, this unit should ship in the second quarter of 1993 and sell for under \$400.

EMBARC/Motorola charges a subscription fee of \$15 a month, which includes an on-line version of *USA Today*. The price of messages is based on their size and the priority assigned to them. To send a 100-character message with overnight priority costs 5 cents; to send a message of the same length with immediate priority costs 50 cents.

Recently, EMBARC/Motorola and Individual (Cambridge, MA) created a service called Heads Up. Subscribers to the service receive abstracts of articles from 96 categories. A subscriber can obtain the full text of an article by dialing an 800 number and identifying the piece with a serial number. The service simply loads the text into the subscriber's electronic mailbox. Heads Up costs \$30 a month for four categories and \$15 for each additional four categories. Full-text versions of stories cost \$5.95 each.

Ex Machina (New York, NY) devotes itself to providing services that enable you to connect your computer to a paging system. The system works with a Motorola pager/receiver that can store up to 2000 alphanumeric characters and forward the data through a serial port. This capability allows you to update laptop computers or personal assistants remotely. For example, a secretary in a main office can cancel or add appointments to a calendar and transmit the changes to a salesperson's portable calendar.

Ex Machina offers developer's kits that enable DOS, Windows, and Mac developers to incorporate wireless data transfer into their applications. The company plans to incorporate other platforms in the future. Ex Machina is also offering software called Notify, which will serve as a gateway between the popular QuickMail program running on the Mac and roaming pagers.

Another company set to offer one-

used in the CDI approach are different than those used by the CDPD system, some cellular carriers may install both systems and let their customers choose. CDI is currently running a test system in Pueblo, Colorado.

Bell Atlantic expects to start selling the CDI system commercially in the first quarter of the year in 25 to 30 cells in the Baltimore area. Among the applications Bell Atlantic sees for the technology are point-of-sale verification, telemetry, vending-machine management, and alarm systems.

According to Mike Franklin, director

of product management for wireless data at Bell Atlantic, the CDI system can make alarm systems more secure, because there are no wires to cut. Alarm services in areas not easily accessible to wired networks (e.g., the monitoring of construction sites) are also ideal for the system. "It's totally portable. It can be here one day and there tomorrow, without having the alarm circuit reinstalled," Franklin says.

Pros and Cons

With billions of dollars at stake, a war of words has broken out between cellular companies and RF service providers. Says

Bell Atlantic's Grlica, "We can utilize our infrastructure to keep the cost of our data network much lower than [that of] others who have to build from scratch."

Lee Horsman, marketing manager for CDI, also cites the advantages of the cellular infrastructure, with its technical personnel and 8000 sites. Each site can send packet-switched data cost-effectively anywhere in the world, because they are all connected to the public switch network, he says.

But the breadth of the existing cellular system also has disadvantages, according to Ardis's Euler. If the cellular companies

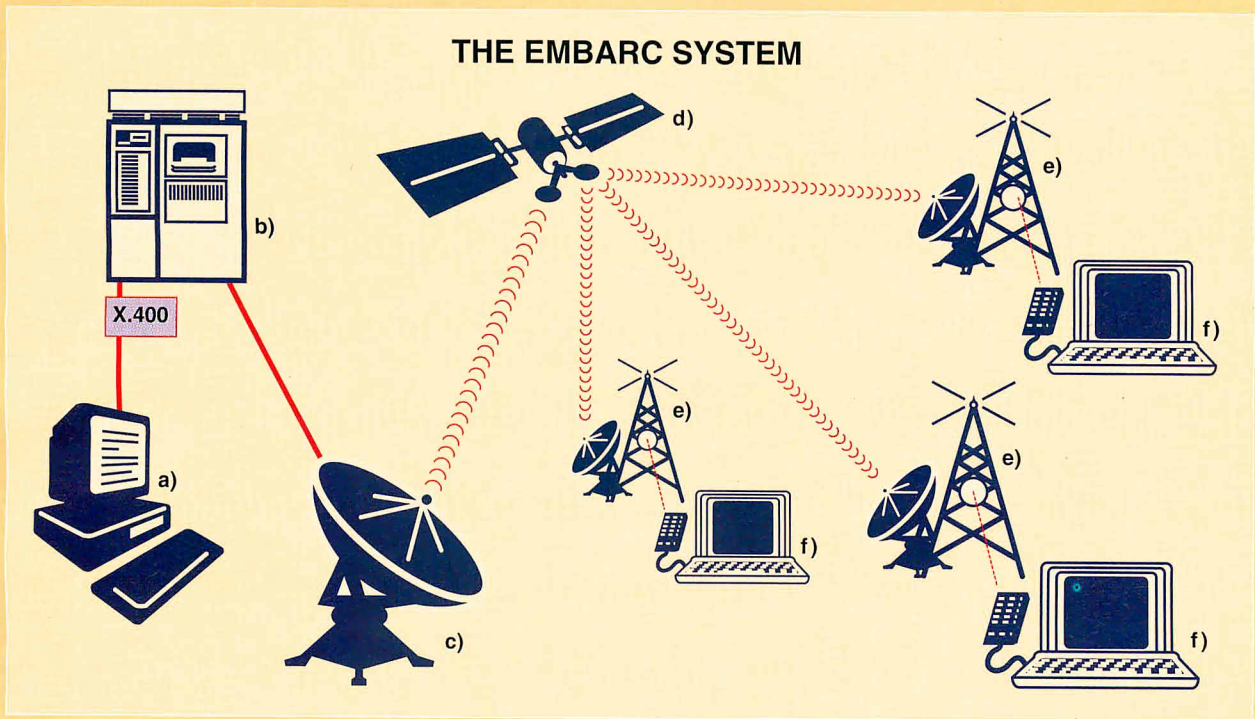


Figure A: You send an EMBARC message from your computer or workstation (a) using X.400 to the central EMBARC switch (b), where a satellite uplink (c) transmits it to a satellite (d). The satellite sends the message to downlink stations (e), which relay them to NewsStream receivers (f).

way E-mail is Cue Network (Irvine, CA). Its ComCard will plug into a Sharp Wizard. The network will offer standard pages, fax mail, voice mail, E-mail, or specialized dispatch messages for trucking companies. The network will also broadcast specialized traffic reports through automatic traffic reporting systems run by Caltrans in California and by the Ministry of Transportation in Ontario, which plans to test this system in Toronto soon.

Mainstream Data (Salt Lake City, UT) is offering a continuous data stream through a combination of satellites and FM radio stations. If you live in a major metropolitan area, you can access the data from the air; if you live anywhere else in North America, you need a 30-inch satellite dish to receive the information. Mainstream offers many news options, including UPI, AP, Dow Jones, Reuters, and more offbeat services like the SportsTicker. An FM

receiver costs \$495; the satellite receiver is priced at \$995. The cost of services ranges from \$80 to \$1000 per month, with the AP wire service fetching the top price.

These systems will likely appeal to companies that need to provide low-cost, limited messaging services in one direction. The systems can use existing paging systems to send large blocks of data, which lowers the cost of the service.

plan to use a packet-switched data architecture, it will require new equipment in each cell site. The capital investment needed to achieve comparable network performance with an existing wireless data network would be substantial.

Aside from the capital costs, industry executives contend there are other reasons why the cellular system is inadequate. Sky-Tel's Warfield says that the cell configuration of the network means that receivers can communicate with only one transmitter at a time. When people want to transmit data, they have to pull off the road, turn on their cellular phone, move it around un-

til they get a strong signal, and transmit.

Euler says that cellular communications are optimized for mobile users, but for in-building communications, packet-switched radio is more reliable. Ardis has approximately 35 antennas in the Chicago area, with in-building coverage for a 35- by 70-mile region. According to Euler, Ardis would need only from five to eight antennas for vehicular coverage.

"Packet switching is only a way to lower the cost for the cellular companies," Warfield says. "It won't increase reliability. It won't get into buildings any better than it does now."

A Place in Space

The two-way systems described thus far are earthbound: They rely on ground antennas to transmit data to roaming computers. This approach works well in New York City, where the population density can support a large packet-switched data transmission system or cellular infrastructure, but it just will not work in Alaska, where cells can be few and far between. Fortunately, satellites are able to fill in the holes.

The Omnitrac system, which is produced by Qualcomm (San Diego, CA), lets you receive messages anywhere in the U.S.

continued

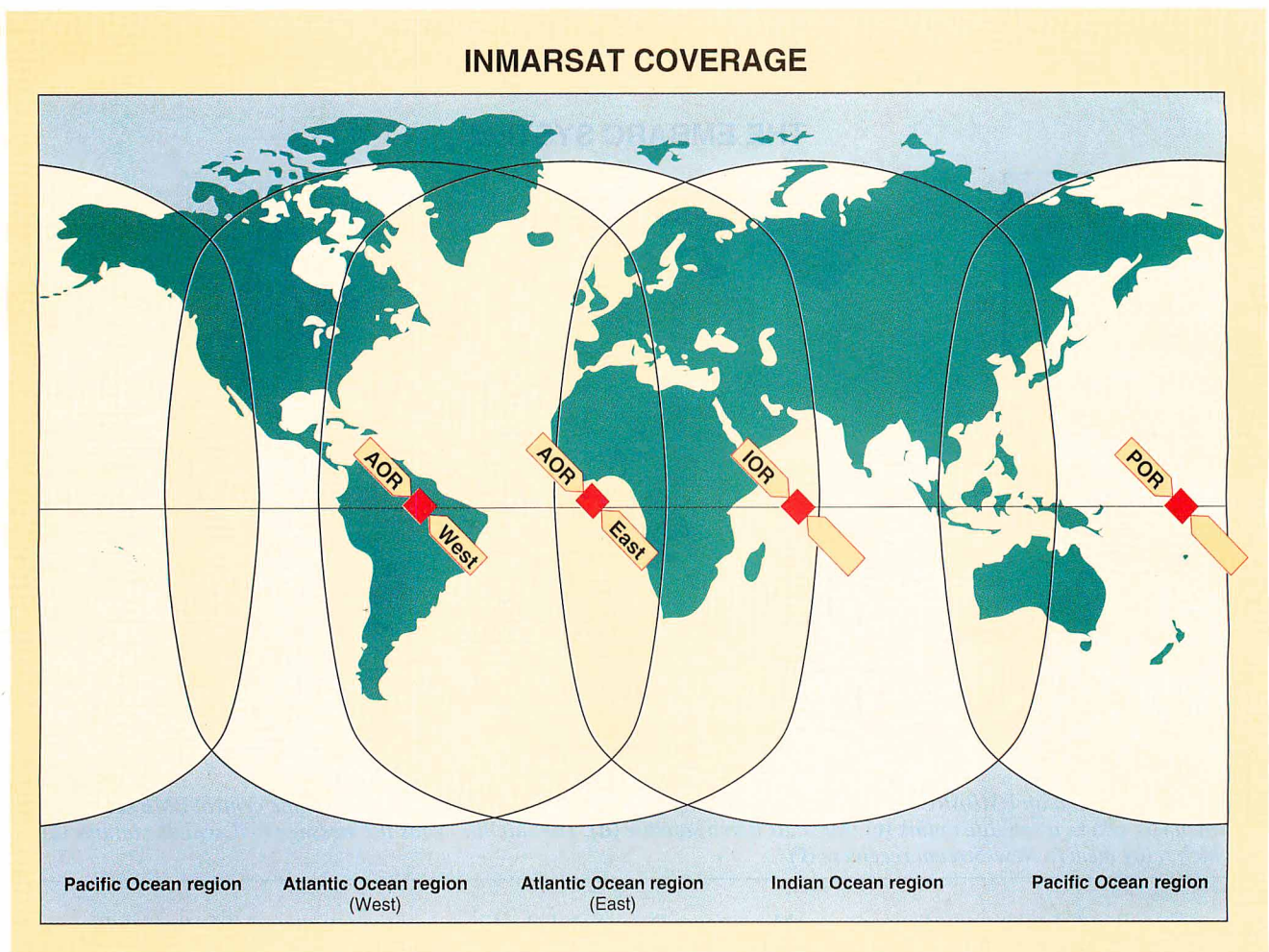


Figure 2: Using four geosynchronous satellites, Inmarsat provides coverage to most of the earth's surface.

Omnitracs is marketed to trucking companies, but some individuals use it, too. Steve Roberts, a spokesman for Qualcomm, drives around the country on a pedal-powered bicycle equipped with the system. The flexibility and mobility of the system, however, require large antennas (the antennas are about the size of a basketball, and they come in weatherproof housing for mounting outside of a truck) and power supplies that can't be carried around and run off AA battery power.

Mobile Telesystems (Gaithersburg, MD) offers Inmarsat, a competing system that covers every location on earth except the North and South Poles (see figure 2). During the Gulf War, CNN correspondent Peter Arnett used the Inmarsat system to send his reporting out of Baghdad when the allied air attack began. He scooped the other networks because, unlike the telephone lines that were cut soon after the attack began, the satellite system continued to operate.

The Inmarsat system provides two dif-

ferent levels of service. The first level transmits voice communication for about \$7 a minute using a base station that retails for \$45,000. The second level provides packet-switched data for about 1 cent a byte. This 13-pound system costs \$10,000. The central switch provides X.25 gateway access to E-mail on the wire-bound networks.

The Pace of Change

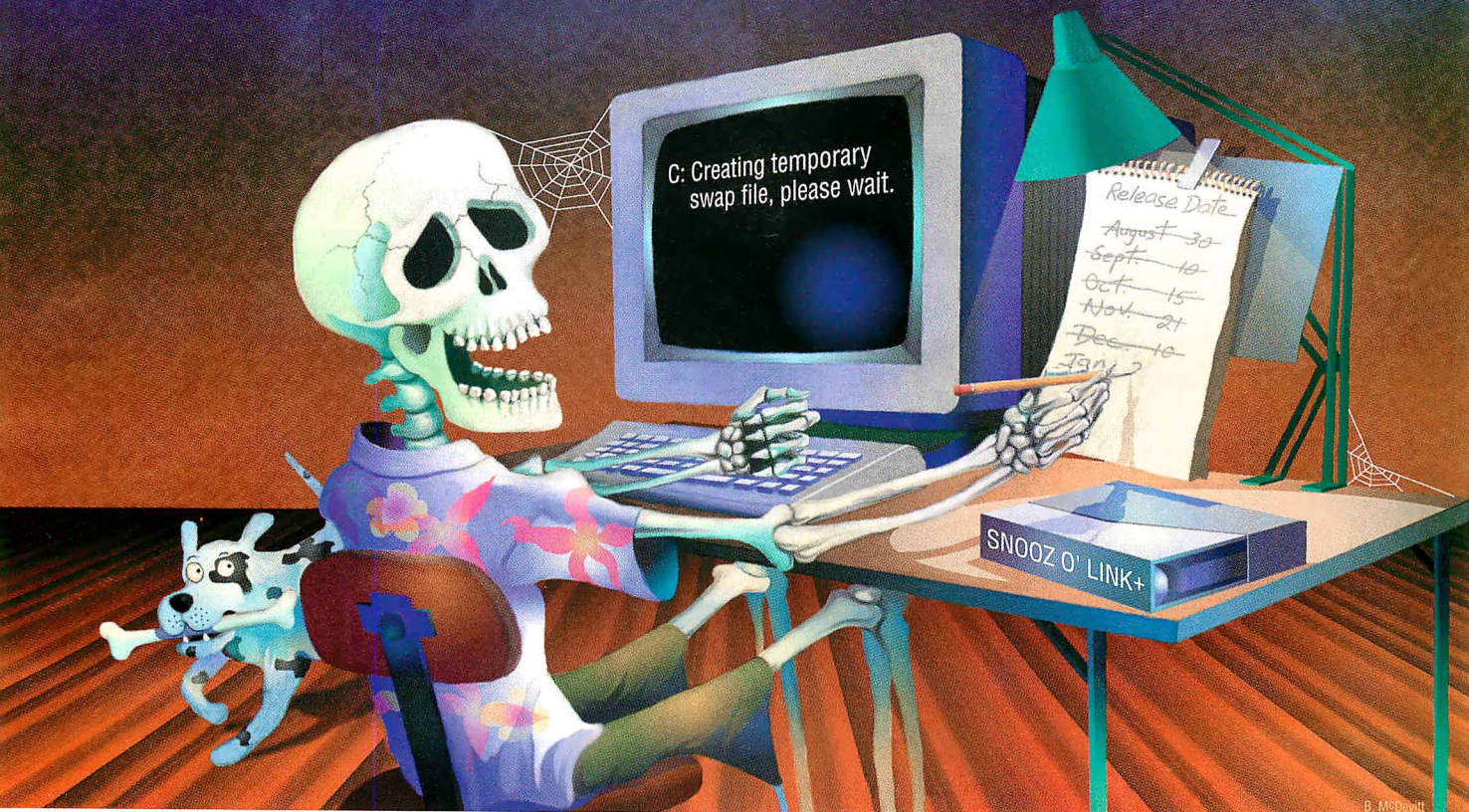
The world of wireless data communications is changing at a fantastic pace. Bell Atlantic announced that it will be starting up a trial version of the CDI system in early 1993. In addition to Bell Atlantic's CDI program, the CDPD system is already being tested in Silicon Valley, and the cellular industry hopes to start installing the system elsewhere by the middle of 1993. And the RAM Mobile Data network will have two new base stations installed per week over the next several months, bringing coverage to over 90 percent of the U.S. population.

The market research firm Forrester Re-

search (Cambridge, MA) expects the number of subscribers to wireless networks to reach 2.5 million by 1997. And according to Motorola, the market for wireless E-mail will reach \$1 billion by 1996 because of advances in business decentralization and portable computing.

The competition over the next several years will be brutal because the standards will be decided, in a large part, by the companies that ship the most boxes. Most of the technical problems involved with wireless data communications are solved, but the marketing is just beginning. Once the infrastructure is mature, wireless mobile computing will be as painless as dialing a telephone. ■

John P. Mello Jr. is a freelance technology writer based in Woonsocket, Rhode Island. You can reach him on BIX c/o "editors" or on MCI Mail at 264-1102. Peter Wayner is a BYTE consulting editor based in Baltimore, Maryland. You can reach him on BIX as "pwayner."



How much longer can you afford to wait?

Create Overlaid Programs-Fast.

BLINKER™, the world's first and fastest dynamic overlay linker, reduces your link time to seconds and reduces program memory requirements. Now you can use one linker for all your software projects.

One Linker, Many Languages.

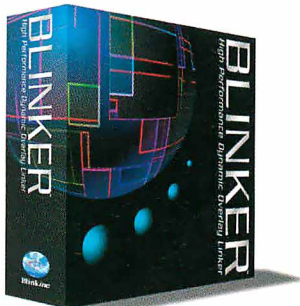
BLINKER 2.0 links and automatically overlays DOS programs written in Microsoft® C, BASIC, Assembler, QuickBASIC™, Fortran, Pascal, Watcom™ C, Zortech® C++, Clipper®, FORCE® and in Borland® C, C++, Assembler, and more.

Save Time and Memory.

BLINKER removes the need for overlay structures, simplifies program design and reduces memory requirements to save you time, effort and memory.

Memory Swap Function.

BLINKER is the ONLY linker to offer an integrated memory swap function, so you can run other large programs from within your program, with negligible memory overhead.



BLINKER™
High Performance Dynamic Overlay Linker

Don't Settle for Less.

Other major features include full CodeView® support, use of EMS/XMS at program run time, and enhanced execution speed of overlaid code.

Time is Money.

BLINKER offers all this in a fraction of the time it takes to link with your current overlay linker. You know time is money, and link time is no exception.

Free Demo

To try our free demo on your own code



Call: 804-747-6700
FAX: 804-747-4200 or

Order now!

If you can't wait any longer, we offer a risk free 30 day money back guarantee. Available in 5.25" or 3.5" diskette format.

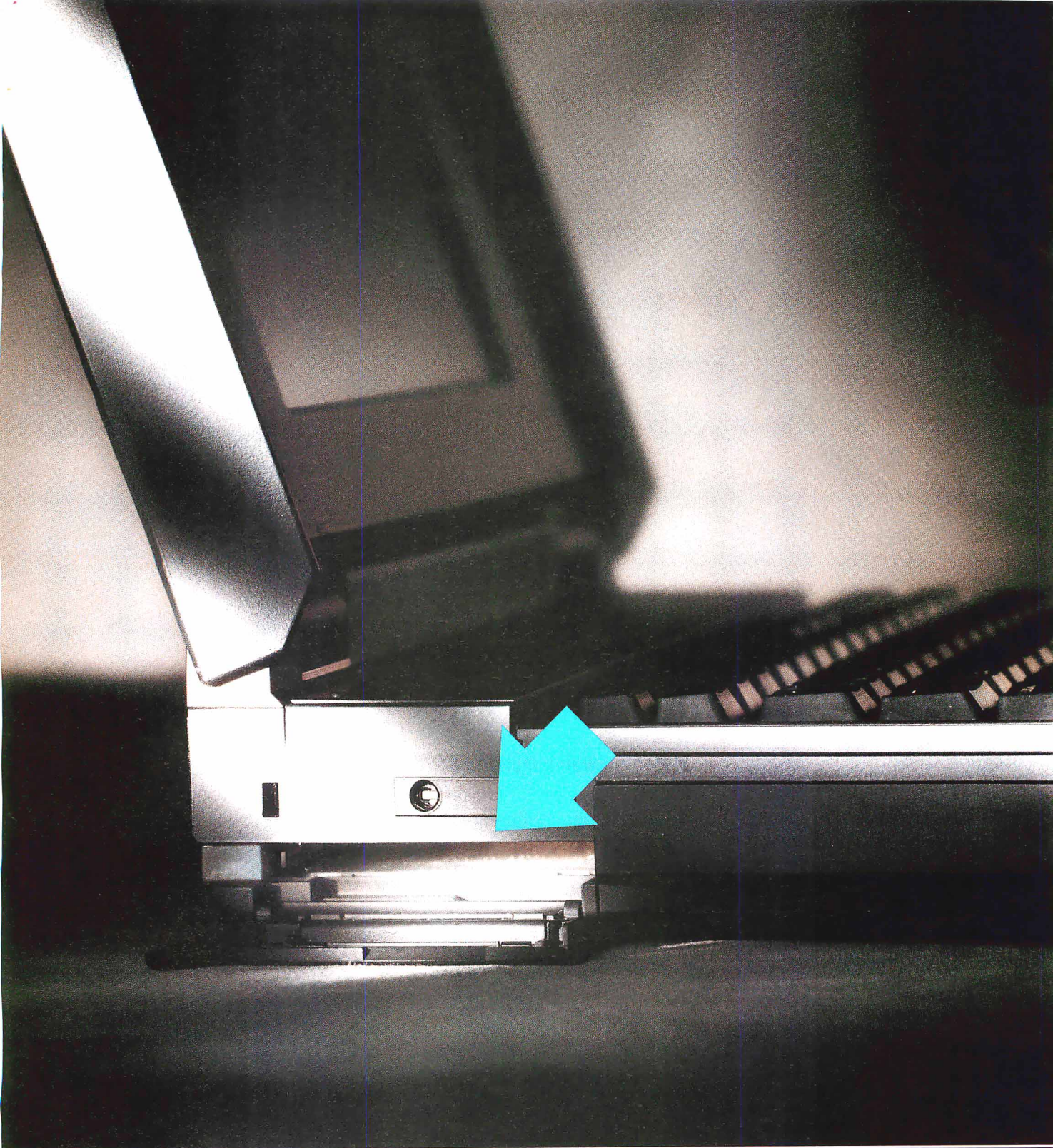
Price \$299
plus shipping & handling



Blinkinc
P.O. Box 7154
Richmond VA
23221

© 1991 Blinkinc. Blinker is a trademark of ASMI, Inc. Offer only applicable in US and Canada.

Circle 152 on Inquiry Card (RESELLERS: 153).



Credit Card ADAPTERS

Insert network here.

As convenient as they are, portables have been out of the network loop long enough.

Now the notebook is the network.

Introducing the IBM family of Credit Card Adapters.

We're revolutionizing the business by miniaturizing our award-winning adapter card technology and conforming it to PCMCIA standards. So almost any portable can operate as a fully enabled node on virtually any network.

Suddenly, personal computing tools are transformed into corporate weapons that can give your enterprise a competitive edge while enhancing your investment in both the network and your notebooks. Imagine providing high-speed data transfer capabilities so users can run applications, retrieve information, and access corporate data with their notebooks.



These new adapter cards are just part of our growing family of LAN solutions meeting your needs now and into the future.

To find out more, talk to your IBM authorized remarketer, or call 1 800 IBM-CALL, ext. S21. If you're looking for someone to help you get more out of your network and your portables, we're ready to fill the slot.

IBM-meeting your LAN adapter technology needs.

- Conforms to PCMCIA Release 2.0 standards.
- 5-year warranty.
- 3 industry standard options: Token-Ring, Ethernet, 3270 Emulation.



Bigger, Brighter, and Flicker-free CTX Professional Monitors

Bringing the Best to Your Windows.

Built with ergonomic ingenuity and trend-setting technology, **CTX Professional Monitors** (available in 14", 15" & 17") are perfect for WINDOWS users:

Flicker-free images at VESA **Non-interlaced** 72 Hz refresh rate reduce eye strain;

High resolutions up to 1280 x 1024 add to image sharpness and increase the amount of information on WINDOWS;

Full Screen Display is a tremendous advantage in Graphics User Interface and Multimedia applications;

Dynamic screen sizing and positioning are achieved through **Programmable Control** in Professional Series (CPS) or **Manual Control** in Multiscan Series (CMS); **Flat-Square Screen** (15" & 17") increases display clarity while reducing distortion and screen glare.

Low Radiation (MPRII) models are available for an additional protection against electro-magnetic radiation.

To rediscover what is coming through your bright WINDOWS, look into a brilliant CTX Professional monitor today.



CPS1460/CMS1461 CPS1760/CMS1761 CPS1560/CMS1561



Where Monitors are CTXellent

CTX INTERNATIONAL
20530 Earlgate Street
Walnut, CA 91789
714/595-6146
Fax 714/595-6293

CTX SOUTH
6090-F Northbelt Pwy
Norcross, GA 30071
404/729-8909
Fax 404/729-8805

CTX EAST
146 Division Place
Hackensack, NJ 07601
201/646-0707
Fax 201/646-1998

CTX MIDWEST
500 Park Blvd., Ste. 425
Itasca, IL 60143
708/285-0202
Fax 708/285-0212

CTX OEM
1225 E. Crosby Rd., A21
Carrollton, TX 75006
214/416-9610
Fax 214/245-7447

©Copyright 1992. CTX International, Inc. All Rights Reserved. All brand or product names are trademarks or registered trademarks of their respective owners.

Circle 78 on Inquiry Card (RESELLERS: 79).

STRETCHING THE ETHER

How wireless technologies
make the most of limited bandwidth

PETER WAYNER

Radio transmission is based on the principle that an accelerating electron creates an electromagnetic field. Such a field accelerates other electrons. Thus, it's possible to move electrons in one place and have the resulting electromagnetic field push electrons in another location. The more electrons you move, the stronger the signal and the farther away it can be detected. All this happens at close to the speed of light.

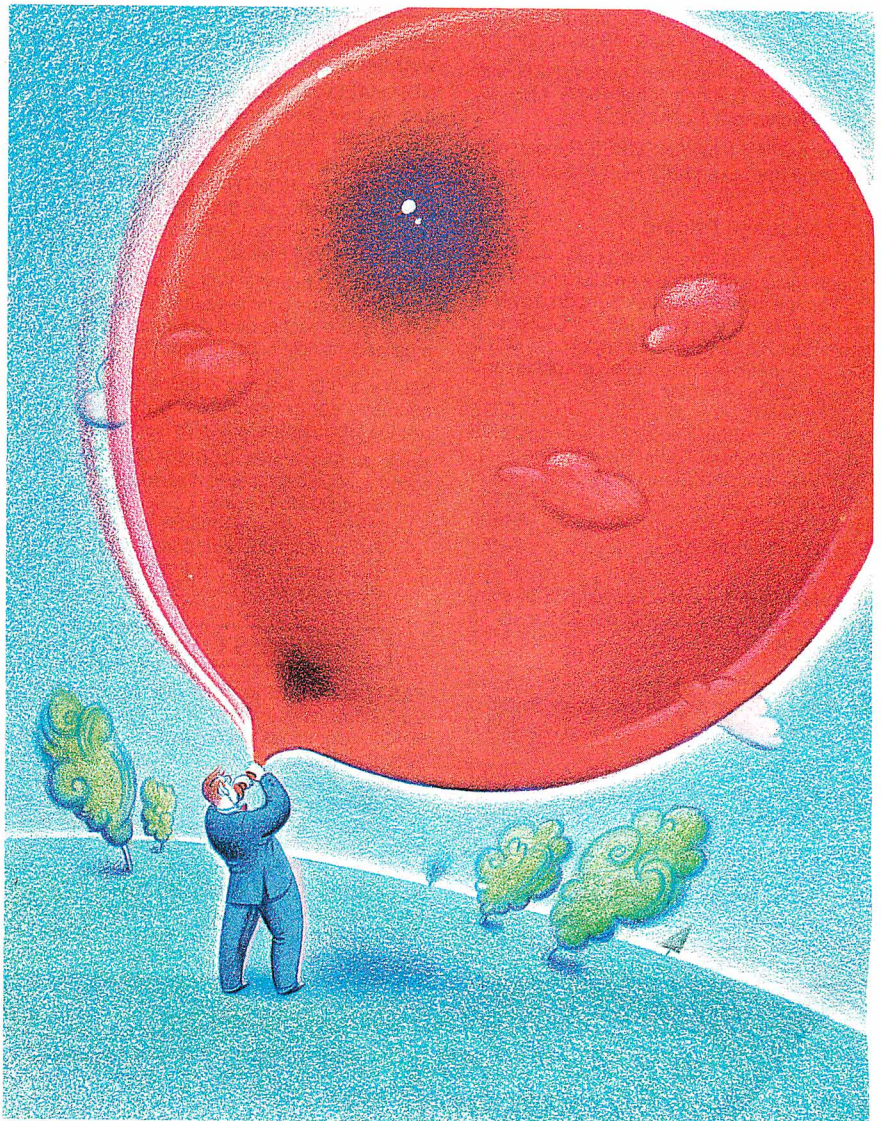
Moving electrons is simple. The trick is to move them in a coordinated fashion. With this capability, you can move information across great distances. And this, in a nutshell, is the basis of wireless data communications.

Radio Waves

The standard approach to radio transmission is to move electrons at a specific frequency and either modulate the strength of the signal (as in AM radio) or make slight changes in the frequency of the signal (as in FM radio). Faster frequencies make it easier to send more information, but faster oscillations require more complicated electronics.

Two signals on the same frequency compete and drown each other out. To avoid this chaos, the FCC allocates parts of the spectrum for specific uses. Early on, TV and radio systems received licenses for their frequencies. The FCC also allocated regions of the spectrum for personal use (e.g., the CB and ham radio bands). But the spectrum is a limited quantity, and the demands of new technologies are putting pressure on the FCC to allocate frequencies to many different groups.

The technical challenge is to pack more users into a narrow band of the spectrum,



OS/2 or NT + 50 MHz = Power!

If you are an OS/2 or Windows NT developer and you are porting an application that needs robust 32-bit support, your wait is over. Microway is currently shipping NDP Fortran-386/486 for OS/2 or NT, along with our C/C++ and Pascal. Our products work with the IBM and MS linkers and can directly access their respective APIs, taking full advantage of the 386/486 gigabyte address space. The biggest advantage of these new 32-bit operating systems over DOS is their

ability to pre-emptively multitask, which dramatically improves the speed of hard disk I/O and multitasking in general.

Microway has also engineered a complete line of 486 workstations which are ideal platforms for both developers and users who are into number crunching. Using removable hard disks, we can set up a system for you that can be used for DOS, NT, OS/2 and UNIX development! Scientists and

engineers will appreciate the fact that our top of the line 486 boxes use industrial strength power and cooling — that's one of the reasons why half of our Number Smasher-860s have gone out in a 50 MHz 486 B³ workstation. Another important reason is the fact that the 860 can save you thousands of dollars per month in Cray or 3090 rentals. For more information, please call Microway's Technical Support Department at (508) 746-7341.

386, 486 and i860 Compilers

Our NDP family of compilers generate globally optimized, mainframe quality code that runs on the 386, i486, or i860 in protected mode under Coherent, DESQview, UNIX, OS/2, or extended DOS. The compilers address 4 gigabytes of memory while supporting the 287, 387, Weitek, and Cyrix EMC coprocessors. Applications can mix code from all three compilers and assembly language. To simplify your ports, we offer ClearView, our full-featured, windowing symbolic debugger that works with DOS versions of NDP 386 and 486 compilers.

NDP Fortran™ is a full F77 with F66 and DOD extensions that is 99% VMS compatible. Also contains new F90 features & MS compatibility.

NDP C/C++™ runs in three modes: K&R with Sys V and MS C extensions; 100% ANSI C; and C++ Release 2.1 compatible.

NDP Pascal™ is a full ANSI/IEEE Pascal, with extensions from C and BSD 4.2 Pascal.

NDP Language Pricing

NDP Fortran, C/C++, or Pascal — DOS products include NDP Tools and Extender. 486 DOS version includes Weitek support, royalty-free binder, and ClearView-386. All DOS compilers come with GREX, Microway's library of 160 MS C compatible lower level graphics and hardware interface routines.

OS/2™ or NT	\$595
386 DOS (includes Tools)	\$695
486 DOS (includes Tools, Royalty-free DOS Extender and ClearView)	\$995
386/486 UNIX V. 3 or V. 4	\$1195
i860 Compilers	\$1995
386 for Coherent	\$295

ClearView-386™ — our windowing 32-bit symbolic debugger that runs with our 386 and 486 DOS products

NDP IMSL is a Microway port of IMSL mainframe library to the i860, 486 or 386. Math Library, Statistical Library, Special Functions

NDP Plot™

NDP NAG™ Workstation library is a subset of the NAG mainframe libraries. Has 172 routines for differential equations and eigenvalue problems, matrix operations, fitting curves, statistics, and regression analysis

Number Smasher-860™

Number Smasher-860 is the highest performance coprocessor card ever to run in an ISA or EISA bus or as part of a transputer system. Delivers up to 80 million floating point operations per second at 40 MHz and produces 11.8 double precision Linpack megaflops. The board comes standard with an EISA or ISA interface, 8 meg of high speed memory, and your choice of NDP Fortran, C/C++, or Pascal for the i860 running under MS-DOS, UNIX, OS/2, SunOS, or DESQview

i860 Vectorizers and Libraries

NDP NAG/860 is a Microway port of the NAG workstation library to the i860

NDP HALO-860 includes HALO Professional and an interface library which makes HALO directly callable by the i860

860 Vectorizer includes PSR VAST-2 which converts a C or FORTRAN program into a new program which calls the Intel Vector library. Includes the Intel Vector Library and Microway's i860 Profiler

860 Vector Library — Written for Intel, includes over 400 vector primitives that take advantage of the i860's cache, dual instruction mode, and pipelined multiplier accumulator

IGL — a 3-D Graphics Pipeline that performs geometry and rendering using routines which use the i860's built-in graphics hardware:

Kuck & Associates CLASSPACK — Hand-coded, pipelined libraries for the i860.

- **Basic Math Library**
- **DSP** — Over 100 routines including 1 and 2-D correlations and convolutions. Does 1024 Complex FFT in 1 msec.
- **Dense Array** solver package

Special! SX Your AT!

FASTCache-SX/Plus™ — The "Windows Solution". Converts your 286 into a powerful 25 MHz 386SX. Combines Microway's award-winning FASTCache-SX accelerator with up to 16 meg of extended memory. Features an Intel 486-style 16K internal cache and 387SX coprocessor socket. Uses a 16-bit slot. Outperforms most SX systems! Installs in minutes in over 100 AT systems including AST, Compaq, Epson, HP, IBM, NCR, NEC, Sperry, Tandy, Zenith and more!

FASTCache-SX-20

FASTCache-SX/Plus-25

Our Tenth Anniversary

Since 1982, Microway has been serving the PC community and we wish to thank all of our customers for their continued support.

386/486 Custom Workstations

A Microway Black Tower is the ideal solution for a cost-effective desktop system, personal supercomputer, file or computation server, or industrial PC. Microway workstations are used in corporations, government research labs and university engineering departments on applications ranging from CAD to financial analysis, software development to basic research. They come standard with two or more thermostatically controlled fans, 250 Watt motherboard power connectors, and American-manufactured industrial grade power supplies. Our 386 and 486 motherboards are carefully burned in and tested. Top speeds are 40 MHz for the 386 and 50 MHz for the 486. Choose from a full line of high quality options to customize your workstation. The base system includes a sleek, black tower case, a black tactile response keyboard, four megabytes of memory, a 250 Watt American power supply and one floppy drive. Each system is backed up by a one year warranty and the best technical support in the industry. Our 486B³™ was a recent *Digital Review* Target Award nominee. Our B³ frequently goes out with three to five i860 cards running NFS on UNIX. With a peak throughput of 400 megaflops, this is the most cost-effective way to boost the power of your Sun network. Microway systems have earned an international reputation for outstanding design, price/performance value and reliability.

386BT ² -40 ISA	64K cache	200W	\$1395
486B ² -T-33 ISA	64K cache	250W	\$2495
486B ² -T-33 EISA	256K cache	250W	\$3395
486B ² -50 ISA	256K cache	250W	\$3995
486B ³ -50 EISA	256K cache	350W	\$4495

Math Coprocessors/Overdrive

WEITEK: 4167-25/33	\$350/\$750
3167-25/33	\$200/\$250
mW3167 Micro Channel-25/33: from \$700	
mW3167/80387 Board	\$200
INTEL: 287XL	\$90
387SX: \$80	387 16-33: \$90
Overdrive 20 MHz: \$425	25 MHz: \$545
RapidCAD	\$350
Cyrix:	
83S87-25: \$79	82S87-20: \$85
83D87-33: \$99	83D87-40: \$129

Microway®

Technology You Can Count On

Research Park, Box 79, Kingston, MA 02364 USA (508) 746-7341
Kingston-Upon-Thames, U.K., 081-541-5466 USA FAX (508) 746-4678
Germany 069-752023 Greece 30 12915672 Japan 047 423 1322 Poland 22-410041

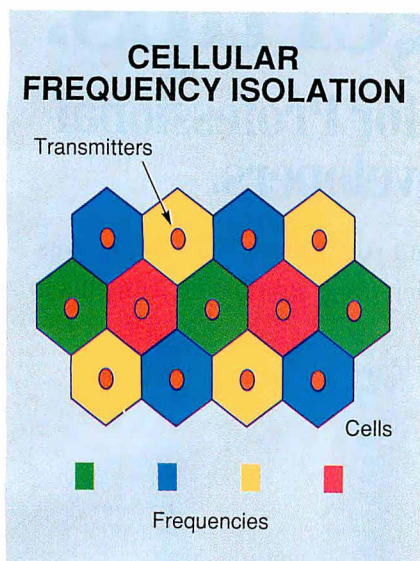


Figure 1: In cellular transmissions, the same frequencies can't be used in adjacent cells. Frequencies must be isolated to avoid interference.

and a good example of this is cellular radio. Before the invention of this technology, radio telephone service was expensive and limited because each call took up an entire frequency. Cellular technology works because the system can limit the power of each signal to the minimum amount necessary. This limits interference to a small area around the base station and the portable phone. When you place many antennas around a city, towers in different locations can use the same frequency without experiencing interference.

Cellular Maps

The standard configuration of a cellular telephone system is a grid of hexagonal cells. Initially, a city may have only one cell. When competition for the limited channels becomes too fierce, the cell can be divided into seven smaller hexagonal cells of one-third the radius of the original cell. The subdivision can be repeated, and some companies talk about nanocellular systems that cover an office building with thousands of cells often no more than 3 or 4 feet in diameter. Adjacent cells must use different frequencies, but cells on opposite sides of the grid can use the same frequency without experiencing interference (see figure 1).

The CDPD (cellular digital packet data) system was designed by IBM and the cellular communications companies to provide data communications in the cellular range without impeding voice systems. The system uses telephone channels just as a modem uses a telephone line, but it's

nimble enough to jump frequencies when a new telephone call starts in the cell. The system is limited by the number of frequencies available in the cell: When all the frequencies are in use, the network locks out new connections. This all-or-nothing performance is different from the data-only network from RAM Mobile Data (New York, NY), in which the data rate merely slows as more users enter the system and compete for free slots.

It's expensive to subdivide a cell and add new antennas and telephone lines to handle new calls. Another method of increasing the capacity of a system is to turn to digital technologies that can use sophisticated compression techniques. The best digital systems model the human voice box to provide the optimal compression of conversation. Some of the best vocoders (i.e., the compression chips that convert voice to bits) can encode a 30-kHz signal in about 4000 bps.

Once voice signals are converted to bits, there are a number of ways of packing the signals closer together. A system known as TDMA (time division multiple access) is able to place three signals into a channel by interleaving them. Another approach that

is being developed by Qualcomm (San Diego, CA), called CDMA (code division multiple access), uses spread-spectrum spreading codes to fit up to 10 times more data into a channel. One frequency can handle several connections at a time (see figure 2).

The CDMA system also includes an improved method of handing off calls between cells. For example, imagine you are cruising along the highway, talking on a frequency, and your car crosses the boundary of the cell. The central station of the

Cellular Transmission

- well-established infrastructure
- lower hardware costs
- lower transmission costs

Packet-Switched Radio Transmission

- more reliable
- faster
- optimized for data

What business does sound have in a computer?

	FY1991	FY1992
12 Revenues		
13 Golf	850,000	935,000
14 Salsor	680,000	740,000
15 Tennis	270,000	297,000
16 Misc	84,400	82,840
17 Total Revenues	1,884,400	2,072,840
18 Operating Expenses		
19 Marketing	94,500	102,060
20 R&D	77,000	84,024
21 Maintenance	69,400	74,952
22 Purchases & Supplies	17,400	18,792
23 Rent	102,400	203,515
24 Depreciation, Building	6,400	7,168
25 Insurance	12,670	13,684
26 Utilities	14,199	15,228
27 Total Operating Expenses	430,710	519,423
28 Income Before Taxes	1,453,690	1,553,417
29 Income Taxes	47,255	52,812
30 Net Income	1,406,435	1,500,605



For starters, you can increase your productivity when you proof spreadsheets with the new Microsoft WindowsSM Sound System. Just highlight a series of numbers or words on the screen and it will read them back to you. It will even read them aloud as you enter them, if you like. To hear more, turn the page.

Essential Development Tools At Your Fingertips.

MKS Toolkit — All the Tools of the Trade for Professional Programmers and Application Developers.

MKS Toolkit puts a powerful suite of easy-to-use development utilities within your grasp. MKS Toolkit was designed by developers for developers. That's how we knew precisely which programming instruments to give you — and how to make them work together so you can achieve levels of productivity you've only dreamed about — until now!

Developers working on DOS can now get the extraordinary power of tools that were once available only on UNIX. Only MKS Toolkit delivers a full suite of these essential tools on your PC, and allows you to switch quickly back to your DOS applications. For multi-platform environments, MKS Toolkit is fully compatible with UNIX systems, and tracks both POSIX and x/Open standards.

Now it's easy to take hold of all the tools of your trade. MKS Toolkit enables you to develop the technology of tomorrow — today.

Start shaping the applications of the future! **Call now to order your copy of MKS Toolkit.**

Some of the 170+ utilities in MKS Toolkit 4.1:

- ▶ A new, easy-to-use, efficient UUCP communications package that connects you to the world.
- ▶ MKS AWK, the fast prototyping and report generating language, now with a new AWK compiler.
- ▶ MKS KornShell, the full-featured programming language that allows you to interchange scripts with UNIX and POSIX systems.
- ▶ MKS Make, the software construction utility that lets you update files automatically.
- ▶ MKS Vi, the full-screen editor.
- ▶ New Windows icons for frequently used commands.
- ▶ Full on-line reference manual.
- ▶ Interoperability with Open VMS, CTOS and MPE/iX.
- ▶ A full array of commands for profiling, compression, archiving, file processing and customizing your PC environment.

MKS 35 King Street North
Waterloo, Ontario, Canada
N2J 2W9

Price: \$299, Upgrade \$99. Call for multi-user pricing. 30 day money back guarantee.
For information on how to order, call MKS at: 1-800-265-2797 (US and Canada)
or (519) 884-2251 • Fax (519) 884-8861. International customers please call:

AUSTRALIA +61 03 580 1333 • BRAZIL +55 83 333 1904 DENMARK +45 87 72 00 • FRANCE +33 1 48 77 22 44 /
+33 1 47 81 10 11 • GERMANY +49 0721 988 280 / +49 0551 50762 0 / +49 06126 595 0 / +49 0221 35 15 24
JAPAN +81 3 5702 0351 • NETHERLANDS +31 020 6 14 24 63 • SWEDEN +46 013 111588
SWITZERLAND +41 061 421 32 01 • UK +44 0364 53499 / +44 0763 244114 / +44 071 833 1022

MKS and MKS Toolkit, MKS KornShell, MKS AWK, MKS Make, MKS UUCP and MKS Vi are trademarks of Mortice Kern Systems Inc.,
UNIX is a registered trademark of UNIX System Laboratories, Inc. All other trademarks are acknowledged.

Circle 104 on Inquiry Card.



cell notices this when your signal becomes weaker. It notifies the neighboring cell to pick up your call, and your telephone must switch frequencies.

This isn't much of a problem when you are talking—you might lose a word or two, but humans compensate for this. But data transmissions are less forgiving, and the lost bits can mangle a fax transmission or a database access. CDMA uses a "soft" hand-off system that lets both cells broadcast the same signal at the same time on the same frequency. As the car moves from one cell to another, the strength of the closer signal grows and that of the old one fades. When your car is in the range of the new cell, the old cell's transmitter stops broadcasting your call.

Data-Only Networks

Pure data networks use different methods than cellular networks. RAM Mobile Data's Mobitex system breaks data into packets of information and transmits the packets individually. The first packet contains addressing information and the number of subsequent packets. The other packets contain 48-bit blocks of data and 21 bits of error-correcting information. All the bits form an overdetermined system of linear equations that have 48 unknowns and 69 equations.

Basic algebra is used to detect and fix errors. If one bit is flipped by mistake, the equations will not be consistent, making it possible to identify and correct single-bit and bit-pair errors. The protocol is capable of detecting errors in up to 15 consecutive bits, although there isn't enough information to correct errors this large. In such cases, the receiver can ask that the data be resent.

The RAM Mobile Data Mobitex network requires that every packet be acknowledged. If it's not, the network rebroadcasts the packet until it is successfully received and acknowledged. This redundancy is important when you drive through a tunnel and break the radio connection. But what if the acknowledgment signal from the portable to the base station is mangled? The base station assumes that the packet did not arrive successfully and rebroadcasts it. Suddenly, your machine is flooded with duplicate packets. This can lead to an endless cycle of acknowledgments. The Mobitex system avoids this problem by labeling each packet with a number from 1 to 15. The stations discard packets with identical numbers.

The RAM Mobile Data Mobitex network accommodates the thousands of transmitters that want to communicate with the base station with a procedure called *slotted aloha*. At predetermined intervals, the base

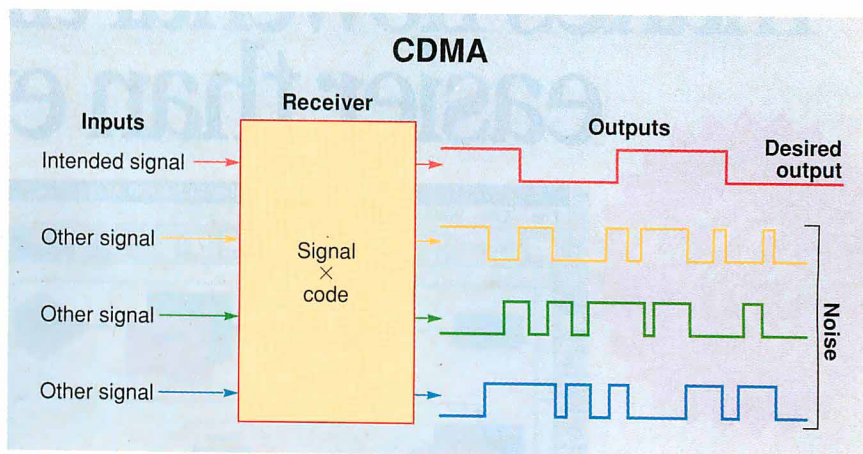


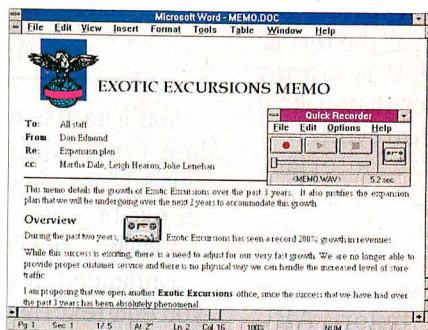
Figure 2: With CDMA, all users share the same frequency, but each signal is created with a unique code—the spreading code—that replicates the original signal when multiplied by the signal. As long as the receiver uses the same code, only one signal at the receiving end will decode clearly—that is, as something other than noise.

station broadcasts a "free" message, which indicates that there will be n slots of free airtime of x milliseconds apiece available. Computers wait for this message and use an internal pseudorandom number generator to choose one of the n slots. The base station

puts these contact requests in a queue and deals with them in turn. Collisions between rival computers broadcasting at the same time are minimal as long as enough free messages are broadcast.

The network's protocol ensures that the

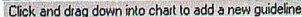
What business does sound have in a computer?



Now you can communicate more effectively by adding your voice, or even music, to documents and presentations. Just record it, drag it and drop it in.

Microsoft Windows Sound System can also recognize and execute spoken commands like *open*, *cut* and *paste*. You can easily create custom commands in any application for the Microsoft Windows™ operating system. Want to hear something else? Turn the page.

NOW SHIPPING



Circle 190 on Inquiry Card.

balance between throughput and free slots can be varied during the day. During periods of high loads, a network might broadcast only a small number of packets before sending a free message to look for new contacts. When the load is low, a network can send many more packets to stations before initiating a free message, because it can be reasonably certain that there will not be many new field units requesting contact.

The Internet Model

A company in California called Tetherless Access, Ltd., is designing a system to link all the computers in a metropolis into a wireless network. The big difference between this vision and that of other networks is that here the computers organize themselves; there is no company controlling the system and taking a few pennies for every squirt of data that is sent over the airwaves.

The basic principle of the TAL network is that each computer routes every packet that comes its way that isn't addressed to it. When a computer wants to send a message, it simply broadcasts the packet with the address, and the other computers in the network repeat the message until it arrives at its destination.

This would seem like a pipedream if it were not for the fact that several networks already operate like this. The computers on the Fidonet and the Internet rely on their neighbors to pass on E-mail, news articles, and other messages. The catch is that the Internet and the Fidonet use the telephone system for packet trading. The TAL network does not need this infrastructure, because the air is still free—although in limited quantities (the FCC allows unlicensed broadcast on only a few small bands).

Overcoming the Odds

A number of technical problems stand in the way of the success of the TAL idea; however, they are not insurmountable. The biggest one is cooperation. All the computers and their transmitters must ensure that they don't step on a signal of another system. Protocols must be designed so that a computer uses the minimum amount of power necessary to reach its neighbors—more power disturbs more people. And the system must design routing networks to make sure that messages are not replicated or sent throughout the network, adding clutter.

Each of these problems has been solved in the laboratory, and it's only a matter of time before networks like TAL's are available to the public. In the meantime, the WINForum (Wireless Information Net-

works Forum) is developing etiquettes for the PCS bands.

There are even more fundamental limitations to a network like the one proposed by TAL, though. The bandwidth of the radio spectrum is more limited than the band-

TAL has a bigger dream of putting a transceiver on every home.

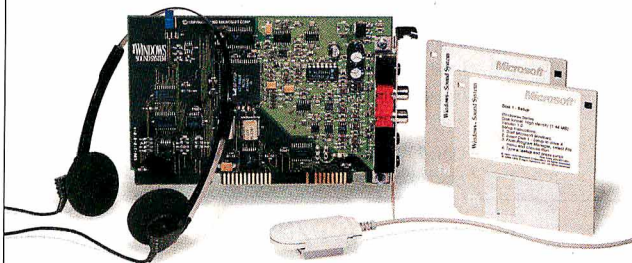
width of wires and fiber-optic cables. Telephone companies are already proposing test systems that will allow each home to receive video on demand. The airwaves cannot begin to approach this level of information flux.

TAL is already setting up a test network for the San Diego library system, using Macs donated by Apple Computer's Libraries of the Future program. It's also starting a larger test-bed in the San Francisco Bay area that will offer a wide range of options. And the company is investigating building networks, linking some of the U.S. Army's Defense Technical Information Centers around the country. These projects will test the ability of computers to cooperate.

Many other companies are bound to address the same questions; however most are limiting their focus to offices. But TAL has a bigger dream of putting a transceiver on every home and letting a network grow around the country. The biggest obstacle is getting enough of the spectrum and developing the momentum to accomplish the task. If the FCC allocates part of the spectrum for these populist data networks and promulgates the necessary rules for its use, TAL may see a shining, wireless network evolve. ■

Peter Wayner is a BYTE consulting editor based in Baltimore, Maryland. You can contact him on BIX as "pwayner."

Microsoft Windows Sound System. You'll be hearing a lot about it.



It's the complete audio solution for your business, with all the hardware and software included. Call (800) 426-9400, Dept. JK8, for a free demo disk that'll bring the Microsoft Windows Sound System to life on your PC. It's the first audio system specifically designed for the Microsoft Windows operating system.*

Microsoft
Making it easier

*Requires the Windows operating system 3.1 or later. Demo is on a 3.5-inch high-density disk. Offer good while supplies last. Inside the 50 United States, call (800) 426-9400, Dept. JK8. For information only: In Canada, call (800) 563-9048; outside the United States and Canada, call (206) 936-8661. © 1992 Microsoft Corporation. All rights reserved. Printed in the USA. Microsoft is a registered trademark and Windows is a trademark of Microsoft Corporation.

Winning Streak, Great Software, SD'93...

The Winning Streak Goes On!

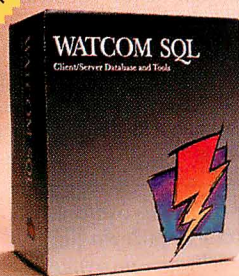
You may have won:

- Fully-loaded 386SX Notebook from GRiD Systems
- Scientific Calculator
- \$10 or \$20 off your next Shop purchase of \$249 or \$399, respectively

YOUR WINNING STREAK PRIZE CODE IS: BP1SL. CALL FOR YOUR PRIZE AND OFFICIAL GAME RULES. Winning Streak is back by popular demand, with valuable prizes and cash discounts for Programmer's Shoppers. Call 1-800-421-8006 for your prize and more information, then head to your fax machine for a free Priority Pass to SD '93, the place where the industry happens. Test drive new and updated products from 200+ companies who cater to developers, and lots more. To get your free Priority Pass to SD '93, call (617) 740-0025 from a fax machine and enter SHOP-093 when asked for a FastFacts number.



NEW
PRODUCT



WATCOM SQL Developer's Edition by WATCOM

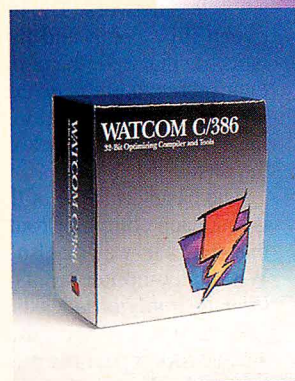
NEW PRODUCT—SPECIAL INTRODUCTORY OFFER. Complete client/server development tool allows you to develop and deploy single-user standalone applications, and to develop applications for use with the Network Server Edition (sold separately). Includes: Single-user database server (both 16- and 32-bit versions); ACME application development system; Embedded SQL/C preprocessor; SQL libraries for WATCOM C, C/386, MS C/C++ and BC/C++.

LIST: \$795 **PS Price: \$379**
FastFacts 1044-035

WATCOM C9.0/386 by WATCOM

Develop and debug 32-bit applications for extended DOS, Windows and OS/2 2.0. Includes royalty-free 32-bit DOS extender, true 32-bit Windows GUI Application Kit, our fast, tight, and reliable 32-bit Code Optimizer, licensed Microsoft Windows SDK Components, an interactive Source-Level Debugger, an Execution Profiler and more! Now includes OS/2 2.0 support.

LIST: \$895 **PS Price: \$599**
FastFacts 1044-029

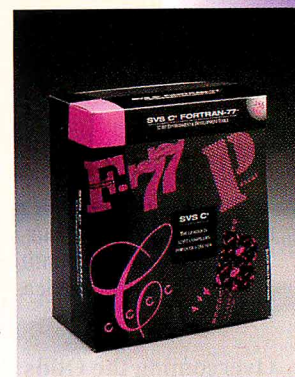


SVS C3 ANSI C, Pascal, or FORTRAN-77 by Silicon Valley Software

Only from the Programmer's Shop! ANSI compliant, optimizing, 32-bit compilers; DPMS-compliant, royalty-free DOS extender; source level debugger; utilities. Supports "flat model" code. Linker, librarian, make, i387 emulation, W31/4167 support. Interoperable languages! Call: 413-572-880

	LIST	PS Price
ANSI C	\$325	\$315
Pascal	\$325	\$315
FORTRAN	\$395	\$375

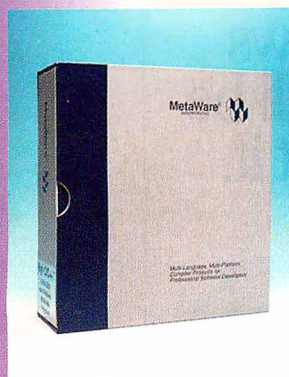
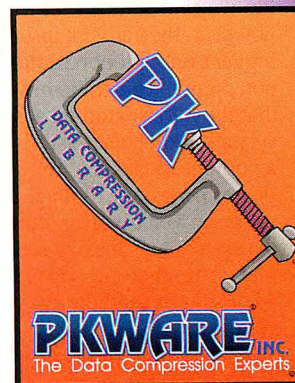
FastFacts 1958-048: (C), 1958-050: (Pascal), 1958-049: (FORTRAN)



The PKWARE Data Compression Library by PKWARE

The PKWARE Data Compression Library allows software developers to add data compression technology to applications. The application program controls all data I/O, allowing data to be compressed or extracted to any device or area of memory. Only 35K of memory is needed to compress data, and only 12K is needed to extract data. Compatible with MSC, BC++, TC, TP 6.0, Clipper, Basic 4.5, 7.1, ASM.

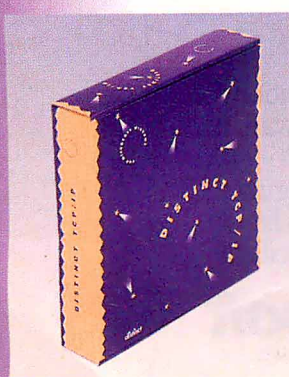
LIST: \$295 **PS Price: \$275**
FastFacts 3043-011



High C/C++ v3.0 by MetaWare Incorporated

MetaWare Incorporated introduces its newest product: the 32-bit High C/C++ compiler, version 3.0. High C++ is a true compiler, not a C to C++ translator. "Incremental Strengths" lets you specify the level of C++ compilation, allowing you to migrate from C to C++ one C++ block at a time. Included in the package is a C++-tailored source-level debugger, and a 32-bit Application Development Kit for Windows. MetaWare offers a full line of multi-language, multi-platform compilers for professional software developers.

LIST: \$795 **PS Price: \$749**
FastFacts 89-063



Distinct TCP/IP for Windows by Distinct Corporation

Distinct TCP/IP for Windows SDK extends the TCP/IP and RPC/XDR networking capabilities to Microsoft Windows. Includes the smallest and fastest DLLs today available for Berkeley Sockets, RPC, Telnet, and FTP. Coexists on the same board with Lan Manager, Novell and Banyan. Supports Packets, NDIS and ODI drivers. Only 5KB of DOS memory required.

(SDK) LIST: \$495 **PS Price: \$439**
(Applications) LIST: \$395 **PS Price: \$379**
FastFacts 1951-003: (SDK), 1951-007: (App.)

...the Programmer's Shop gives you all three. Shop the Shop.



Visual Basic for DOS by Microsoft Corporation

Draw forms, controls; write event-procedures; create custom controls—in DOS! Create new apps or combine with existing C/C++ or Pascal code. Highly compatible with Visual Basic for Windows. Run existing Quick Basic/Basic PDS code! 80x86 compiler creates 100% standalone .EXE files; 386 code generation; MOVE overlays; an integrated ISAM and much more!

	LIST	PS Price
PRO	\$495	\$339
Standard	\$199	\$139

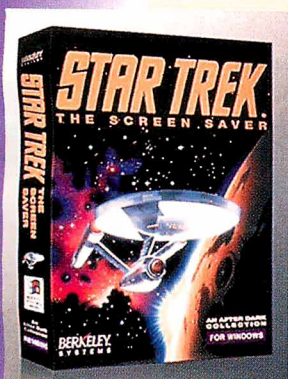
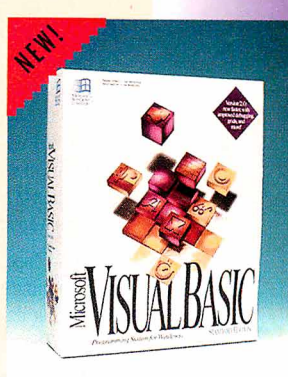
FastFacts 502-408:(PRO), 502-407:(Stand.)

Visual Basic for Windows 2.0 by Microsoft Corporation

When you need to create a Windows application quickly, nothing offers the sheer productivity of Microsoft Visual Basic 2.0, Standard Edition. A visual development environment, flexible programming language, and fast runtime execution make this the shortest route to full-featured Windows applications. The Professional Edition includes messaging and data access capabilities, a wide variety of add-on tools, and more.

	LIST	PS Price
PRO	\$495	\$399
Standard	\$199	\$139

FastFacts 502-443:(PRO), 502-431:(Stand.)



Star Trek™ : The Screen Saver. by Berkeley Systems

Beam aboard the Enterprise™ with Captain Kirk and Mr. Spock on a mission to prevent screen burn-in. Encounter trilling Tribbles, Klingon battlecruisers, and burrowing horta. This all new screen saver provides over 15 animated displays, password protection, SystemIQ and full compatibility with After Dark.

LIST: \$60 **PS Price: \$39**

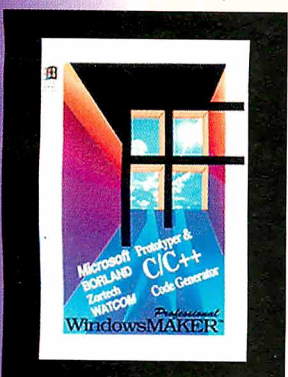
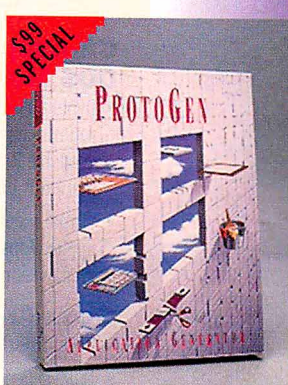
FastFacts 2900-007

ProtoGen 3.0 by Protoview

NEW VERSION! The industry standard for code generation and prototyping Windows applications. Develop the user interface of your application using Visual prototyping methods. ProtoGen generates expert level, commented code for ANSI C, Microsoft MFC C++, Borland OWL C++, Turbo Pascal, and Microsoft NT Win32. All generators included! User Code is preserved from one generation to the next. It's easy and fast.

LIST: \$199 **PS Price: \$99**

FastFacts 2115-009



WindowsMAKER™ Professional by Blue Sky Software™

Considered the easiest and fastest way to create MS-Windows applications in C/C++. Generate the Windows .EXE w/complete source & production files (no royalties). Just Point & Click to define the Windows user interface. Lets you animate your design to instantly test look & feel and make changes on the fly without needing to compile. Custom code is preserved during code regeneration. The leading development tool for Microsoft Windows. Highly Recommended.

LIST: \$995 **PS Price: \$895**

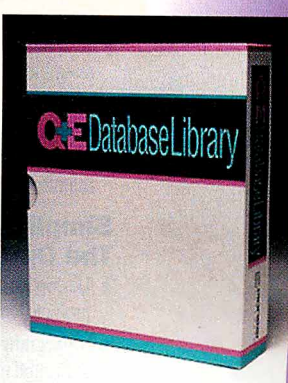
FastFacts 2001-006

Q+E Database Library by Pioneer Software

Q+E Database Library provides complete database connectivity to Windows and OS/2 applications using Dynamic Link Libraries. QELIB can read, insert, update, create or delete database records for the following database formats: Btrieve, dBASE, DB2, Excel files, INGRES, NetWare SQL, Oracle, OS/2 DBM, Paradox, SQL/400, SQLBase, SQL/DS, SQL Server, Sybase, Tandem NonStop SQL, text files, and XDB.

LIST: \$399 **PS Price: \$339**

FastFacts 2137-012



But wait, there's more: Bargains galore!

	LIST	PS		LIST	PS		LIST	PS
• After Dark for Windows	50	28	• DR DOS	99	59	• ObjectVision 2.1	150	115
• Blinker	299	269	• LapLink Pro	170	109	• ProComm Plus	129	89
• Borland C++ 3.1	495	319	• Lotus 1-2-3 for Windows	495	359	• QuattroPro	495	349
• Btrieve for DOS	595	399	• MS Excel	495	329	• R&R Report Writer Xbase Ed.	249	159
• Carbon Copy 6.1	199	165	• MS Windows 3.1	150	99	• WATCOM C 9.0/386	895	599
• Clarion Prof. Developer 2.1	845	469	• MS Word (Windows)	495	339	• WordPerfect	495	279
• Clipper	795	499	• Norton Desktop for Windows	179	139	• 286/DOS Extender SDK 2.5	495	435
• DESQview 386	220	149	• Norton Utilities	179	115	• 386/DOS Extender SDK	495	435

Call the Programmer's Shop today: 1-800-421-8006

Mention Code BY293

Call FastFacts for product information any time, day or night. 617-740-0025.

Get free information on all of our more than 10,000 products any time you like • Dial from a fax machine or fax-board equipped PC • Follow the voice computer's instructions • Receive literature instantly via fax

THE PROGRAMMER'S SHOP

Canada 800-446-3846

MA 617-740-2510

FAX: 617-749-2018

90 Industrial Park Road, Hingham, MA 02043

• Credit card orders processed only when product is shipped • All prices subject to change
• International prices will vary

Create and Deliver Professional Applications with New CA-Clipper 5.2

Create And Deliver Professional Applications With CA-Clipper

CA-Clipper consists of a robust language, an efficient linker, flexible preprocessor and high-performance compiler. Together with tools such as an editor, debugger and make utility, these elements form a complete development system for the creation and distribution of professional PC and LAN-based applications.

Only CA-Clipper gives you an open programming environment with high-level networking, data entry and database support. The extended memory system capability of CA-Clipper gives you additional power to build faster, more sophisticated applications.

CA-Clipper Shatters DOS Memory Barriers

- Dynamic overlay management lets you run applications that exceed available RAM—without the need to manually create overlays
- Virtual memory management allows applications to have up to several megabytes of strings and arrays

Open Architecture: Freedom to Grow

- Customize CA-Clipper with user-defined commands and functions
- Build generic libraries to eliminate repetitive programming tasks
- Build specialized libraries for applications such as accounting, real estate and personnel
- Seamlessly integrate modules from languages such as C, Assembler, dBASE® and Pascal
- Access data transparently from foreign data sources with Replaceable Database Drivers and function libraries (available separately), including data on LAN database servers and mainframes via gateways

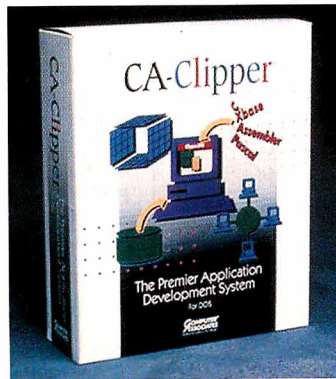
Simplicity and Control: The Optimal Balance

- Descriptive function/command names and concise operators promote language fluency
- Syntax ranges from simple, expressive commands to precise string and file primitives for minimal programming with maximum control
- CA-Clipper promotes disciplined, modular programming for easier debugging, simplified maintenance and greater code reusability
- High level "objects" simplify the construction of sophisticated interfaces. Build pop-up and pull-down menus, custom BROWSES and text editors quickly and easily

Open Networking: Freedom to Connect

- Create and distribute multiuser applications without LAN Packs or workstation licenses
- Applications run on all networks which support MS-DOS 3.1 and higher
- Modest memory requirements allow smooth operation with even the largest network shells

- Full-featured record and file locking gives developers precise concurrency control
- Intelligent design permits read-through record and file locks
- Applications run quickly and reliably, even as networks evolve



PC Magazine Editor's Choice
CA-Clipper, version 5.01 received the PC Magazine Editor's Choice award for Xbase Development Systems in May 1992.

COMPUTER ASSOCIATES
Software superior by design.

- Connect to LAN database servers with Replaceable Database Drivers (available separately)

Free Distribution of Applications

- CA-Clipper produces executable applications (EXEs) that you may distribute without additional cost
- Multiuser CA-Clipper applications require NO licenses, NO runtime fees and NO LANPacks

Capacity

- Procedures per application: unlimited
- Functions per application: unlimited
- Array size: 4,096 elements per dimension, unlimited dimensions
- Expanded Memory use: 0 to 32 MB
- Virtual memory: up to 64 MB (main memory, expanded memory, hard disk space); up to 16 MB of object memory

(character strings, arrays); up to 9 MB (main memory, expanded memory) for database buffering

Supplied Database Driver (DBF Format)

- 1 billion records per data file
- 1,000 fields per record
- Over 200 open data files (limited to file handles)
- 15 active indexes per open data file
- Character fields (fixed length): 65,536 characters
- Numeric fields: 30 digits, precision up to 16 significant digits
- Support for logical fields (true/false)
- Date fields: 01/01/0100-12/31/2999
- Memo fields (variable length): 65,536 characters

System Requirements

CA-Clipper 5.2 requires an IBM PS/2, AT, XT, PC or its compatibles; 640K RAM; expanded memory requires LIM 3.2 or higher; hard disk required for development; DOS 3.1 or higher; works with all networks compatible with DOS 3.1 or higher.

For a limited time only!

Clipper users can upgrade to version 5.2 for only \$139. A competitive upgrade is also being offered for a limited time to all Xbase system users for only \$179, and you'll receive a free CA-dBFast, CA-Clipper Tools or CA-Clipper/Compiler Kit for dBASE IV (your choice).

To qualify for the competitive upgrade, fax a copy of your manual cover to 617-749-2018.

To order, call the Programmer's Shop at 800-421-8006. Hurry, time is of the essence. Call to place your order today. Mention Code BY293

To Order Call **THE PROGRAMMER'S SHOP** 1-800-421-8006

COMMUNICATIONS GET PERSONAL

AT&T unveils its plans
for the personal communications revolution

BOB RYAN

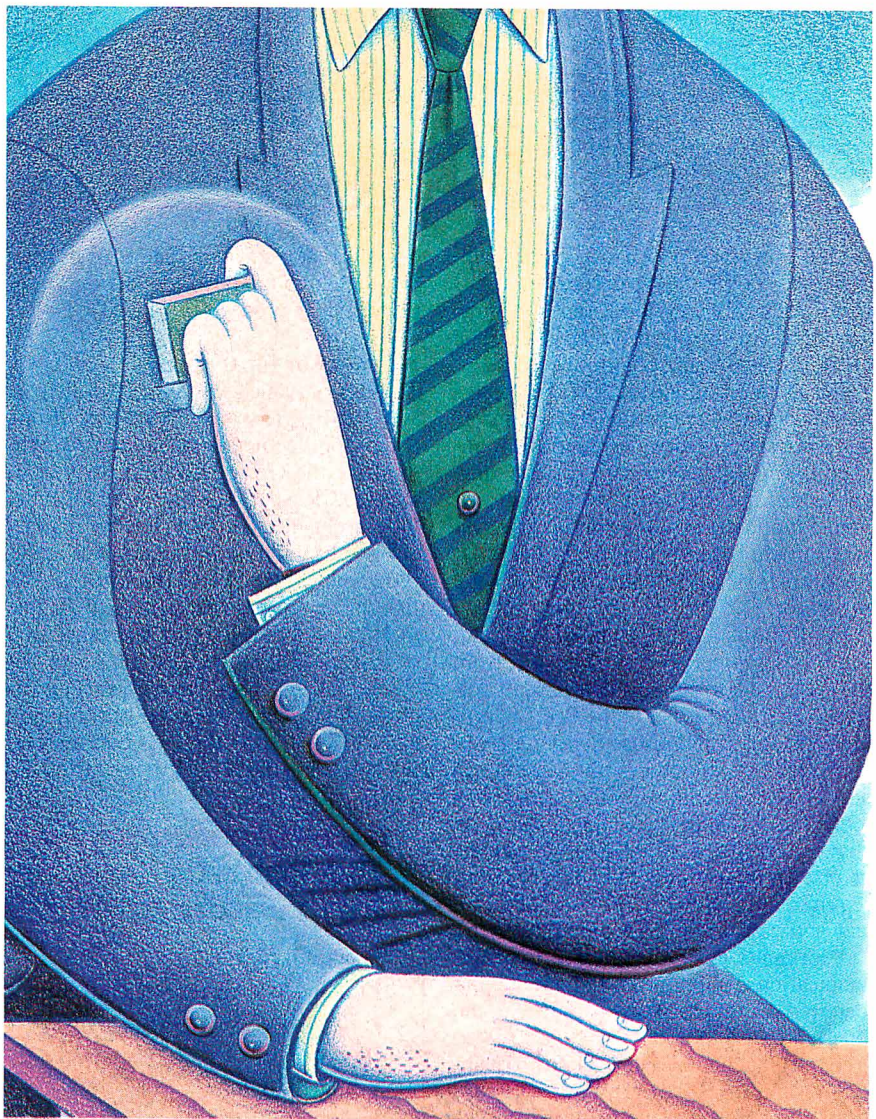
Hand-held systems such as Apple's Newton are advancing a vision of computing that sees the personal computer not as a miniature main-frame but as an intelligent, highly sophisticated personal communications device. Behind this view are a number of technologies—wireless communications, low-power processors, object orientation, and advanced integration—that are falling into place. Also important is the realization that these machines don't have to be compatible with desktop computers: They just have to be able to communicate with them.

With a personal communications device, you carry the computer and communications services (or your connections to them) in your pocket. The Newton made its big splash last summer (see the text box "Apple's PDA Vision" on page 170). Now AT&T—Apple's former partner in developing a low-power processor—has weighed in with its own vision of the future of personal communications.

The Computer as a Telephone

In conjunction with Go Corp., AT&T has recently entered the personal communications arena in a big way. AT&T and Go hope to establish their view of personal communicators as a standard platform for personal communications devices.

As you might expect, AT&T takes a slightly different approach to personal communications devices than does Apple. According to Rakesh Sood, director of marketing of personal communications systems for AT&T Microelectronics, the AT&T-Go initiative takes as much or more of its content from the telephone as it does from the computer: "The primary application is personal messaging, such as fax,



Apple's PDA Vision

Last summer, Apple Computer announced the Newton (see photo A), a pen-based system weighing less than a pound and designed to go anywhere that you do (see "The PC Gets More Personal," July 1992 BYTE). Dubbed a PDA (Personal Digital Assistant), the Newton features a low-power, high-speed RISC processor; a 32-bit multitasking operating system; and Intelligent Assistant software.

Intelligent Assistant performs complex tasks based on your pen input. For example, if you tell it to send E-mail to Susan, it would get Susan's E-mail address from your computerized Rolodex, construct the message with the proper headers, and then transmit the message if you have a connection or defer transmission until you connect

the Newton to a wired or wireless communications service.

When it ships early this year, the Newton will offer limited communications capabilities. Using a built-in infrared link, you will be able to connect two Newtons or link a Newton to an AppleTalk network. In addition, the Newton will have a wired link that will enable it to exchange data with Macs as well as PCs.

The limitations of the Newton's initial communications capabilities are related to infrared technology. Infrared communications are *line-of-sight*—that is, you have to be able to see the re-



Photo A: Apple's Newton.

ceiver to make and maintain a connection. Also, infrared communications are susceptible to interference from rain, snow, and smog, making them short-range.

Apple is well aware of the limitations imposed by using infrared technology in PDAs and is pushing into the realm of radio-based wireless communications (see "Stretching the Ether" on page 159).

In fact, Apple's objective is to make it possible for a PDA to establish a digital connection to another computer from any location on earth. Only then will the promise of the Newton truly be fulfilled.

E-mail, and voice. Voice is a critical component." AT&T set out to create a platform that could handle all types of messaging, from paging to voice mail. The result is the personal communicator.

For the joint initiative, AT&T supplies the basic hardware components; a processor and support chips designed for high-speed, low-power operation; and some custom chips that support modem and voice applications. Go supplies the system software—a version of its PenPoint operating system written for the AT&T processor.

PenPoint is a 32-bit, object-oriented, multitasking operating system built from the ground up to support pen-based computing (see "The Point of the Pen," February 1991 BYTE). Because PenPoint is object-oriented, a PenPoint application has access to the operating system's code and to the code of other applications. This code sharing is critical to personal communicators, because it cuts down on memory requirements, which in turn reduces the size and power requirements of a system.

PenPoint's design is tailored for communications. Support for immediate and deferred communications is built into the operating system.

Even though PenPoint is a known quantity with a small but growing software base, the hardware side of the personal-

communicator equation is new. At its heart lies the Hobbit, a new, low-power, high-performance processor from AT&T.

A Processor for C

The Hobbit (which was formerly called the ATT92010) grew out of Bell Labs' efforts to develop a computer architecture to complement the C programming language. Dubbed CRISP (C Rational Instruction Set Processor), the architecture was originally designed to optimize the performance of programs written and compiled in C. The first silicon implementation of CRISP came in 1986, and development has continued ever since. But in the past few years, the CRISP design specification has been expanded to include low-power performance. The ATT92010 is the first commercial manifestation of the CRISP architecture.

The Hobbit's Key Features

- optimized for C
- memory-to-memory architecture
- two independent three-stage pipelines
- branch folding

Beyond the fact that it's a 32-bit microprocessor fabricated with a 0.9-micron double-metal CMOS process, the Hobbit bears little resemblance to the RISC and CISC processors that dominate desktop computing. Most processors—including all RISC and CISC chips—use a register-to-memory architecture. The processor loads an operand into a register before acting on it with an instruction. After processing, the result—usually a modified operand—is written from the register back to memory. The Hobbit, on the other hand, uses a memory-to-memory architecture. This means that it has no registers that are directly accessible to a programmer.

Caching the Stack

Early on in the development of CRISP, AT&T researchers found that roughly 5 percent of all C language instructions were either procedure calls or returns and that nearly half the execution time of register-oriented machines involved procedure-call overhead. Beyond this overhead, most instructions were simple, with branching instructions being the most common. These facts shaped the design of CRISP: A C-rational processor had to have low procedure-call overhead and a reduced penalty for branches.

While an operand stored in a register can be accessed at least an order of magnitude

CodeBase 5.0

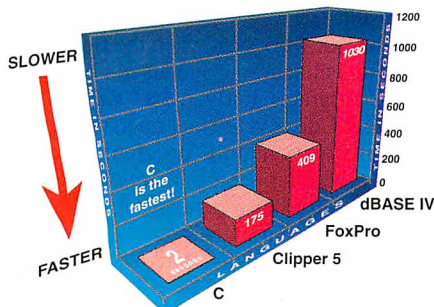
Discover why FoxPro, Clipper, and dBASE were all written in C.

There is a good reason why your database language was developed in C. In fact, there are many good reasons.

C code is small. C code is fast. C code is portable. C code is flexible. C is the language of choice for today's professional developer. With the growing complexity of database applications, C is a realistic alternative. Now with CodeBase 5.0, you can have all the functionality, simplicity and power of traditional database languages together with the benefits of C/C++.

C speed - fast code, true executables...

FoxPro, Clipper, and dBASE were written in C primarily for speed. But those compilers don't really compile, they combine imbedded language interpreters into your .EXE. Now that's slow. For dazzling performance you need the true executables of C. With CodeBase you get the real thing, C code. Consider the following statistics, from the publisher of Clipper:



C size - small executables, no added overhead...

FoxPro, Clipper and dBASE would like you to believe you need their entire development system to build database applications. But

remember, those products are all written in C. So why do you need to lug all their extra code around? You don't. CodeBase is a complete DBMS, in C. No fat executables stuffed with unused code. No runtime modules. No royalties. Just quality C code. CodeBase is just what you need.

C portability - ANSI C/C++ on every hardware platform...

No other language exists on more platforms than C/C++. Why rewrite your entire application for DOS, Windows, Windows NT, OS/2 or UNIX? With CodeBase the complete C source code is included, so you can port to any platform with an ANSI C or C++ compiler. Now and in the future.

dBASE Compatible data, index and memo files...

You want the industry standard. You need compatibility. Sure, dBASE is the standard, but every dBASE compatible DBMS product uses its own unique index and memo file formats. Only CodeBase has them all: FoxPro (.cdx), Clipper (.ntx), dBASE IV (.mdx) and dBASE III (.ndx). Now it's your choice, we're compatible with you.

Announcing CodeBase 5.0

The power of a complete DBMS, the benefits of C

NEW - Multi-user sharing with FoxPro, Clipper and dBASE...

Now your multi-user C/C++ programs can share data, index and memo files at the same time as concurrently running FoxPro, Clipper and dBASE programs. No incompatibilities. No waiting.

NEW - Queries & Relations 1000 times faster...

CodeBase 5.0 now lets you query related

data files with any logical dBASE expression. Our new Bit Optimization Technology (similar to FoxPro's Rushmore technology) uses index files to return a query on a 1/2 million record data file in just a second. Automatically take advantage of this query performance by using our new CodeReporter:

Product Sales Summary			
Month of:	Nov, 1992	Product	Quantity
		Database	63
		Spread Sheet	58
		Monthly Summary	121
		Value	\$25,137.00
		Value	\$21,066.00
		Value	\$47,003.00

Product Sales Summary			
Month of:	Dec, 1992	Product	Quantity
		Database	62
		Spread Sheet	53
		Monthly Summary	115
		Value	\$24,562.00
		Value	\$19,875.00
		Value	\$44,737.00

Summary			
Month of:	Nov, 1992	Product	Quantity
		Database	63
		Spread Sheet	58
		Monthly Summary	121
		Value	\$25,137.00
		Value	\$21,066.00
		Value	\$47,003.00

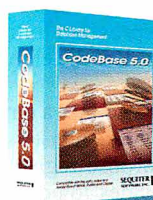
To use CodeReporter, simply draw your report, then include it in any program you write. Call 403/437-2410 now for your FREE working model of CodeReporter.

New - Design complex reports in just minutes...

Our new CodeReporter takes the painstaking work out of reports. Now simply design and draw reports interactively under Windows 3.1, then print or display them from any DOS, Windows or UNIX application.

SPECIAL - FREE CodeReporter

Order CodeBase 5 before Feb. 28, 1993 and receive CodeReporter for free! This offer includes our no-risk, 90-day money back guarantee, so order today!



CodeBase 5.0
The C/C++ Library for DataBase Management

Call Now
403-437-2410

SEQUITER SOFTWARE INC. FAX 403-436-2999
Europe 33.20.24.20.14
#209,9644-54 AVE., EDMONTON, AB, CANADA T6E-5V1

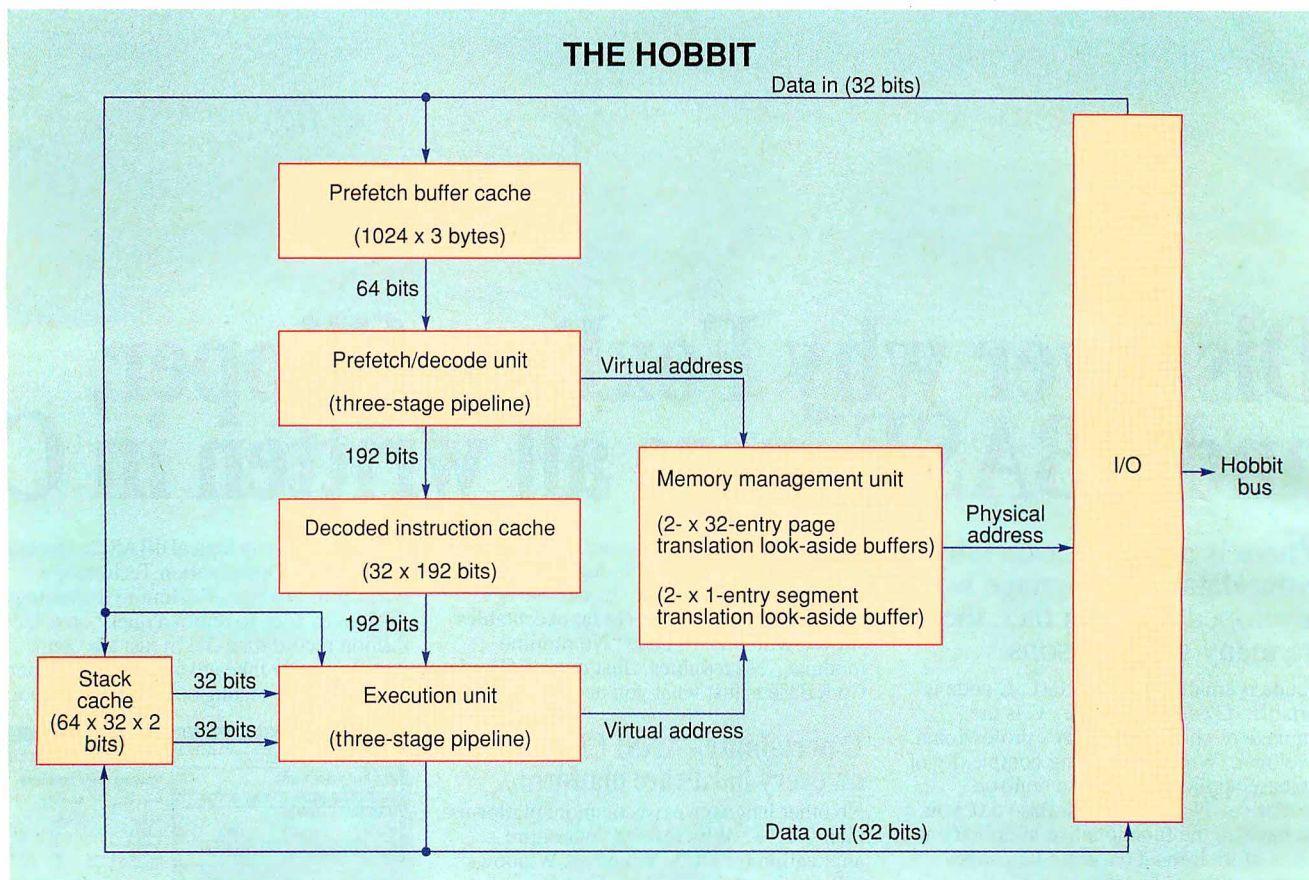


Figure 1: The primary execution pathway in the Hobbit consists of two three-stage pipelines coupled by a cache. The prefetch/decode unit transforms instructions into the 192-bit format that the execution unit requires. The execution unit determines addresses, fetches operands, and computes and stores results. If an operand is in the stack cache, it's available to the pipeline without delay. (Courtesy of AT&T Microelectronics)

faster than one stored off-chip, registers are big contributors to procedure-call overhead because their state must be saved across such calls. Thus, for a C-rational processor, general-purpose registers just didn't make sense.

The Hobbit avoids the drawbacks of general-purpose registers by using an on-chip 256-byte stack cache for fast processor access to operands. The top of the user stack is on-chip, greatly reducing the overhead required to perform procedure calls and returns, which normally store parameters on the stack. A standard processor would have to store one set of parameters from registers to the stack and load a second set from the stack whenever a program initiated a procedure call. The stack cache eliminates these loads and stores.

The stack cache is organized into a circular buffer of 64 32-bit hardware registers. It's as fast as a general-purpose register file, but like a cache, it resides logically in the system memory-address space. The stack cache is transparent to software, so its size can be increased in future versions

of the Hobbit without sacrificing software compatibility.

Hobbit Plumbing

Its lack of general-purpose registers aside, the Hobbit borrows features of its design from both the CISC and RISC architectures. Like CISC processors, its instruction set supports multiple addressing modes, and individual instructions can access up to $2^{1/2}$ memory locations—two memory-based operand reads and a write to the accumulator. Such complex, variable-length instructions permit higher code density than RISC processors, an important consideration when you're coming up with a processor for portable devices.

From the RISC world, the Hobbit borrows pipelines. The core of the Hobbit consists of two independent three-stage pipelines: a prefetch/decode unit and an execution unit (see figure 1). The latter is loosely coupled to the former by a decoded instruction cache. The prefetch/decode unit takes instructions from the prefetch buffer cache and decodes them into 192-bit

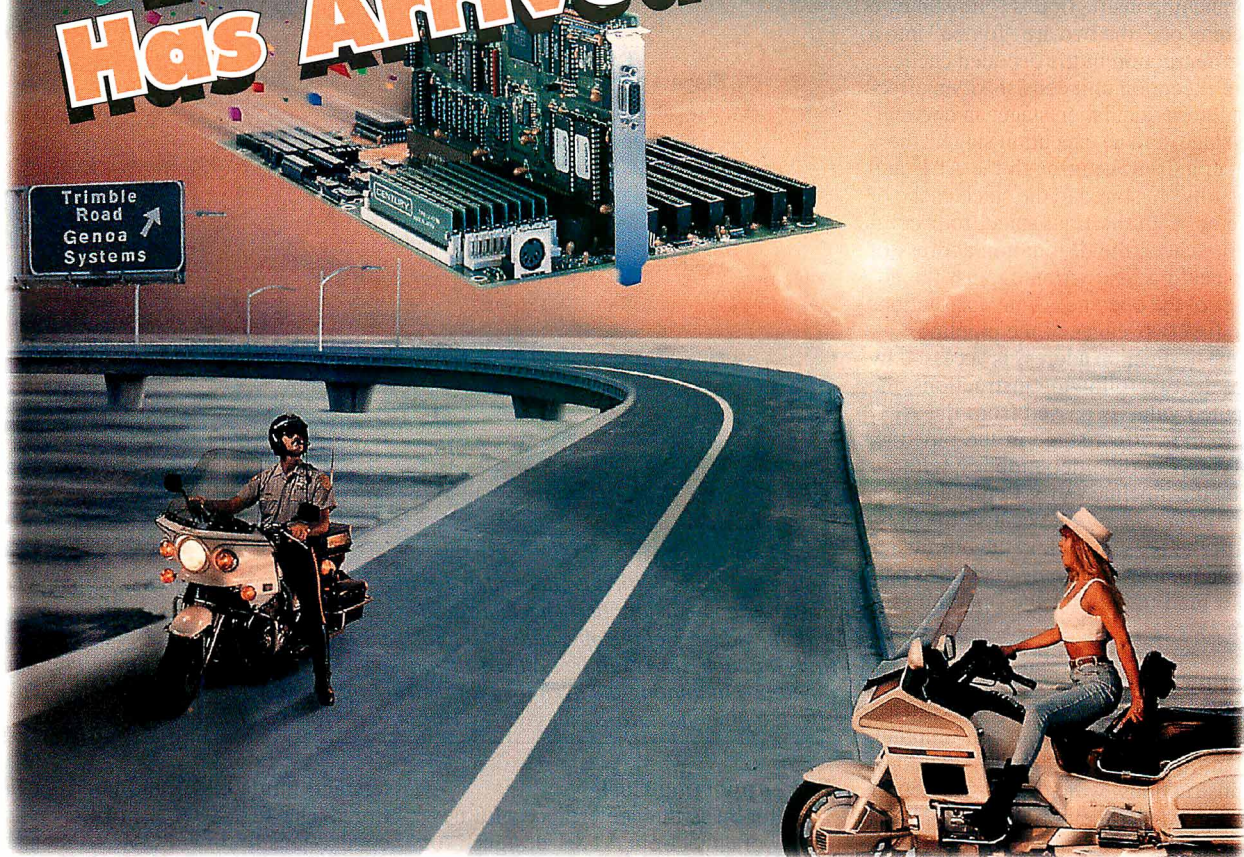
instructions for the execution unit. The execution unit reads decoded instructions from the decoded instruction cache, retrieves the necessary operands from the stack cache or from off-chip, and stores the result.

Pipelines work best when the flow of a program is linear, but such is not the case with C programs. Early in the CRISP project, AT&T discovered that up to one-third of all instructions in C programs run on VAXes were branching instructions (the VAX was used as a benchmark because, unlike load/store machines, it uses complex, multioperand instructions). A mechanism was needed to deal with all the branch instructions that the Hobbit would be faced with.

To do this, AT&T uses *branch folding*. Every instruction in the decoded instruction cache contains two 32-bit fields that can hold the addresses of possible successor instructions. The logic to calculate these addresses is located on the input side of the decoded instruction cache. Thus, every instruction placed in the cache is a

The VESA Local Bus Has Arrived!

Call today for pricing.
1-800-93-GENOA
(SALES ONLY PLEASE)

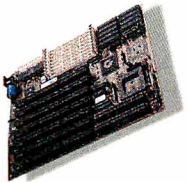


Speed And 16.8 Million Colors With The TurboBahn Series From Genoa

WindowsVGA 24 (Model 8500VL) - Fast 24-bit graphics accelerator at 32-bit speed. 16.8 Million colors at up to 640 x 480 and 64K colors with up to 800 x 600 resolution. 1MB DRAM display memory. VESA, IBM VGA, EGA, CGA, MDA and Hercules compatible. Advanced drivers include AutoCAD®, AutoShade™, Lotus® 1-2-3, OS/2® 2.0, Microsoft Windows™ 3.1, and more. FlickerFree™ 70 or 72Hz vertical refresh rate. Two year warranty.



WindowsVGA 24
(8500VL Model)



TurboExpress 486VL

TurboExpress 486VL Fast motherboard performance (300% increase over ISA bus) incorporating the latest in VESA Local Bus technology. Supports up to 50MHz and 256 cache. CPU - 486 SX-20, 25 / 486 DX-33, 50 / 486DX2-50, 66 combinations. Seven 16-bit expansion slots consisting of two VESA local bus slots. Two year warranty.

Accelerator / Driver Combination	Winmark (16.8 Million colors in 640 x 480 Resolution*)
Genoa Model 8500VL with Genoa Driver	2.159 Million 1.42
S3 86C805 Adapter + S3 Driver	0.828 Million .55

Genoa
SYSTEMS CORPORATION
The Ultimate Graphics Solution

* Benchmark results were collected using 640 x 480 resolution in 16.8 Million color mode, Winbench 3.1 on a 486DX / 33 VESA local bus. Other Colors and resolutions will vary. ©Genoa Systems Corporation 75 East Trimble Road, San Jose, CA. 95131 all rights reserved. TurboBahn, TurboExpress and WindowsVGA are trademarks of Genoa Systems. All other registered trademarks and un-registered trademarks are the property of their respective owners. Specifications are subject to change without notice.

Circle 81 on Inquiry Card (RESELLERS: 82).

branch instruction, because it contains the addresses of all possible follow-on instructions. If during instruction decoding a nonbranching instruction is followed by a branching one, the two are "folded" into a single instruction in the decoded cache.

The execution unit consists of an effective-address calculation stage; an operand-fetch stage; and an execution stage, where the operands move through the ALU and the results are stored to the stack cache or to memory. In the final stage, four comparators check the destination address of the executing instruction against the addresses of the operands of the instructions in the first two stages of the pipeline.

If the destination address is accessed by one of the two following instructions, the computed value is passed from the ALU back to the correct stage in the pipeline, satisfying the data dependency without stalling the pipeline. AT&T calls this procedure *read canceling*, because the presence of the passed-back value eliminates the need for a follow-on instruction to perform a read to acquire the operand (see figure 2).

Sweating the Details

With the stack cache limiting off-chip accesses, which reduces power consumption, and with the instruction unit using complex instructions, which results in denser code and smaller memories, the Hobbit is well served by its architecture as a processor for low-power, small-form-factor computing devices. It's also well served by its design and the way it's manufactured.

AT&T uses a CMOS process to fabricate the Hobbit, resulting in low power consumption—250 milliwatts at 20 MHz and 3.3 V. The Hobbit also features a stoppable clock that reduces power consumption when the processor is within a range of from the standby mode to 50 microwatts. Finally, the integration of the instruction prefetch buffer, the stack cache, and the memory management unit on the 0.92cm² chip lowers the chip count and power requirements of Hobbit-based devices.

Despite its low power consumption, the Hobbit is no performance slouch. In benchmarks that AT&T released at last fall's Microprocessor Forum, it outperformed Intel's low-power 386SL by a factor of three, using less than one-quarter of the power. Its performance is similar to that of the ARM610 used in the Newton, and it uses less power. At 20 MHz, the Hobbit puts out about 13.5 VAX MIPS.

The Hobbit can run at 5 V or 3.3 V, so it can use today's numerous 5-V peripherals or tomorrow's 3-V devices. It can even use lower voltages. AT&T expects the chip to sell for about \$35 in quantity.

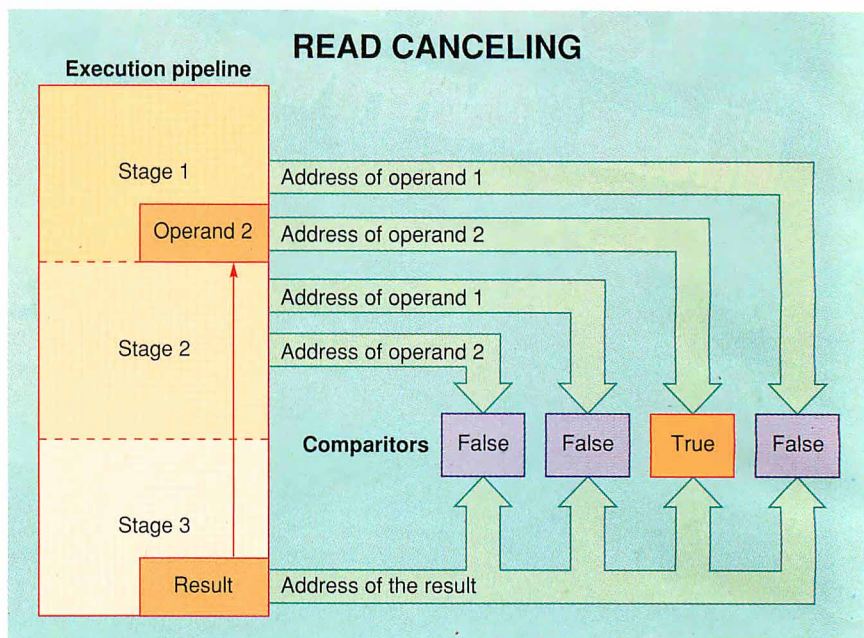


Figure 2: To deal with data dependencies that would normally stall a pipeline, AT&T uses four comparators that check the address of the result of the instruction in stage 3 with the address of the operands of the instructions in stages 1 and 2. If a comparator finds a match, the result from stage 3 is passed to the appropriate instruction in the pipeline, eliminating the need for that instruction to read the operand address. In effect, a pipeline hazard can give the Hobbit a performance boost.

The Supporting Cast

The Hobbit is the centerpiece of a new family of chips from AT&T designed for use in personal communicators. Other members of the family are the ATT92011 SMD (System Management Device), the ATT92012 PCMCIA Interface Device, the ATT92013 P-ISA Interface Device, and the ATT92014 Display Controller. All these PCS (personal communication services) devices can interface with the Hobbit, run at 3.3 V or 5 V, and provide 3.3- to 5-V translation.

The SMD handles bus arbitration and power management; generates the system clocks; and contains an asynchronous serial port, a keyboard/pen port, 256 bytes of battery-backed SRAM (static RAM), and a real-time clock. The SMD's power management functions are impressive: It can selectively shut down parts of the system (including the Hobbit) that aren't in use or shut down the entire system (including itself) until it receives an interrupt from the real-time clock or gets an on/off signal. The SMD can also refresh DRAM during a shutdown.

The other three PCS devices control communications with peripherals. The P-ISA Interface Device provides a connection between the Hobbit CPU bus and a peripheral bus that is a subset of the ISA bus. This subset doesn't support bus mas-

ters and limits DMA and interrupt functions. The PCMCIA controller handles connections to three PCMCIA slots. The controller supports PCMCIA 2.0.

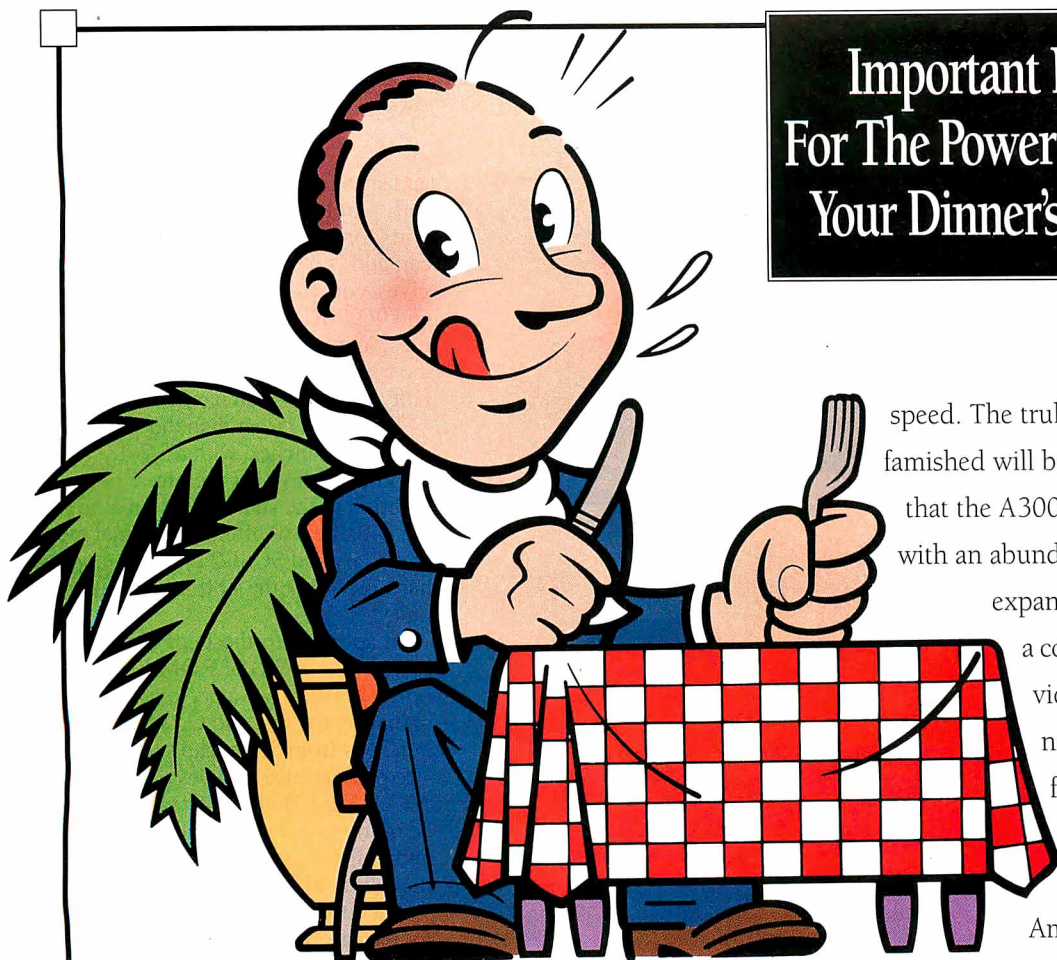
The video display controller lets the Hobbit drive color and gray-scale LCDs. It supports three display sizes—640 by 240, 640 by 480, and 1024 by 768 pixels—and up to nine gray levels. The top gray level is used to display the ink of a pen-input device. The controller also has built-in support for 17 dither patterns (16 for the display plus one for ink). Color displays are able to use nine color patterns out of a palette of nearly 5000 patterns. The controller can also drive CRT displays using an external RAMDAC.

Moving Targets

With this foundation, AT&T hopes to create a dynamic environment for independent software vendors and OEMs. Development systems and software development tools have been available since last year. AT&T anticipates that a wide range of systems will be designed around the base platform and that systems will become less expensive and more capable.

Over the next few years, AT&T will concentrate much of its effort toward integrating the functions of the Hobbit support chips onto the same die as a processor. In addition, communications, compression,

Important News For The Power Hungry: Your Dinner's Ready.



speed. The truly power famished will be happy to know that the A3000T is stuffed with an abundant selection of expansion slots. There's a co-processor slot. A video slot for internal devices. Up to four PC slots. And up to five Zorro III slots. Every Amiga 3000 series computer comes with

Come and get it.

The new Amiga® 3000T multimedia workstation tower—the most expandable, flexible Amiga ever built.

Now powered by a 25 MHZ Motorola 68040 CPU, the A3000T is faster than ever



before. (Current A3000T users can upgrade to a 040-based accelerator card.)

The A3000T features a 200MB hard disk drive. A 3.5" floppy disk drive. 5MB of RAM, expandable to 18MB. And 32-bit bus architecture to transfer mammoth amounts of information at breakneck

Commodore Express™ Gold Service options.* And convenient leasing terms are available.

Now, you'd expect a power feast like this to carry a fat price tag. But now with our new low price, you can sit down to an Amiga 3000T for just \$2,875.** Which in itself is a powerful reason for seeing your Commodore dealer today. For a dealer near you, call 1-800-66-AMIGA. In Canada, call 1-800-661-AMIGA. Bon appetit.



Commodore
AMIGA

© 1992 Commodore Business Machines Inc. Commodore and the Commodore logo are trademarks of Commodore Electronics Ltd. Amiga is a trademark of Commodore-Amiga, Inc. Products available on GSA schedule GS-00K-91-AGS-5069. * Available only on systems purchased in the U.S. through an authorized Commodore-Amiga dealer. Customer activation required. Some optional programs include a charge. **MSRP, monitor sold separately.

Circle 70 on Inquiry Card.

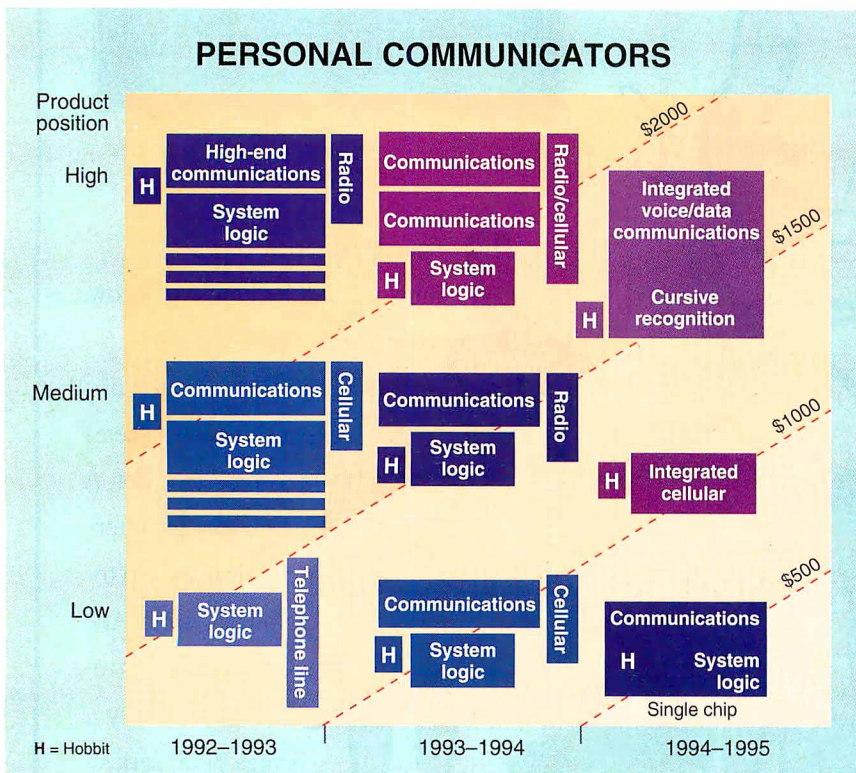


Figure 3: AT&T expects that the effects of integration and market forces will make this year's high-end personal communicators the low-end systems of 1995. (Courtesy of AT&T Microelectronics)

handwriting recognition, and other custom functions could also be integrated onto the processor chip (see figure 3).

Offerings from OEMs are scarce. But EO (Mountain View, CA) plans to ship two personal communications systems—the 440 and 880—by the time you read this.

The 440 is a tablet measuring 7.1 by 10.8 inches and weighing, in the basic configuration, 2.2 pounds (see photo 1). It uses a 20-MHz Hobbit and comes with 4 MB of RAM and 8 MB of ROM. All software is in ROM. The 440 has a PCMCIA Type 2 slot for expansion; a microphone

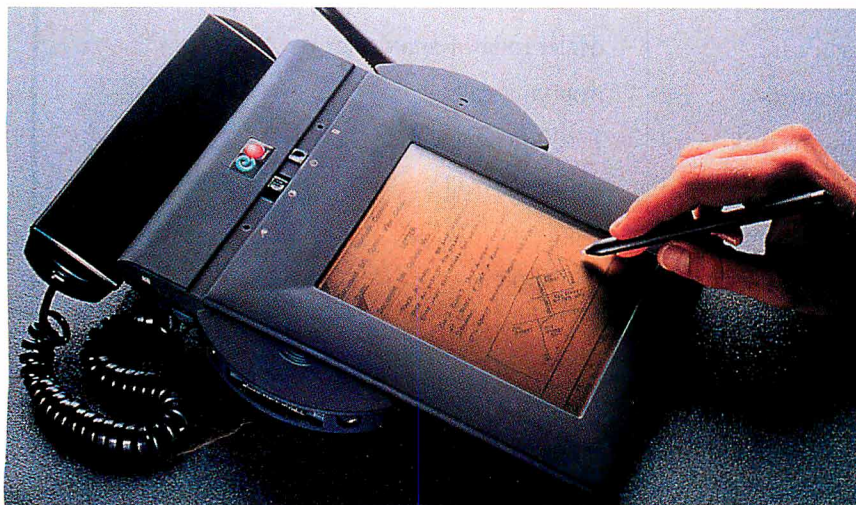


Photo 1: The EO 440's screen is a standard 640- by 480-pixel VGA display with 110-dot-per-inch resolution. Shown is the optional CellPhone module, which lets the internal modem work over the cellular telephone system.

and speaker for voice annotation; and serial, parallel, keyboard/pen, and phone ports for communications. One option you can add is a V.32bis data modem, which gives you 14.4-Kbps data transmissions and 9600-Kbps send/receive fax capabilities. You can also add 8 MB of RAM to the system and a 20-MB Hewlett-Packard Kittyhawk 1.3-inch hard drive.

The 880 is larger than the 440, measuring 9 by 13 inches, with a 5.7- by 7.6-inch backlit display that weighs 4 pounds. In addition to the standard features found in the 440, the 880 offers an internal modem and VGA and SCSI-2 ports. The optional hard drive for the 880 is a 1.8-inch IDE unit.

In addition to the PenPoint operating system, the 8 MB of ROM contains PenSoft's Perspective, a personal information manager; Go Fax and Go Mail, from Go; PenTops from Sitka; and several utilities. The package also includes a subscription to AT&T Mail. Both the 440 and the 880 can be outfitted with optional cellular adapters and cellular phones. The basic price for the 440 is \$1999; the 880 costs \$2999.

The EO systems are significant not only for the capabilities they offer but for the direction they take. Serious communications capability is built into every system, and wireless communications—in the form of analog cellular—and voice are options. As the technologies mature, you can expect these capabilities to be incorporated into the base system and that EO or third parties will offer digital cellular and packet-switched radio options for the machines. In addition, battery performance will improve dramatically as more 3-V peripherals become available. Although the core and memory of the 440 and the 880 operate at 3 V, most of the peripherals operate at 5 V.

There and Back Again

AT&T's personal communicator is a bold attempt to bring the power of computers to bear in personal communications. As with any new technology, the first year or so will see trade-offs, as manufacturers try to balance the conflicting needs of portability and advanced communications capabilities.

As digital-cellular and packet-switched-radio technologies mature and more 3-V peripherals become available, the conflicts between portability and capability will lessen, and personal communicator systems will provide both qualities. The changes that they will bring to the way you work and play cannot be predicted, but they will be impossible to ignore. ■

Bob Ryan is a BYTE technical editor. You can reach him on BIX as "b.ryan."

YOUR DIRECT LINK CARD

For free product information, mail your completed card today. For quicker response, fax to 1-413-637-4343!

Yes, I want **FREE** information on the following products!

1. Circle the Numbers on Your Direct Link Card

Circle the numbers which are found on ads and articles in this issue or circle the product category number and receive information on all advertisers listed in that category.

2. Print Your Name and Address

Answer questions "A" through "E" and mail or fax card to 1-413-637-4343.

3. Product information will be rushed to you from the selected companies!

Fill out this coupon carefully. Please Print.

Name _____

Title _____

Company _____

Address _____

City _____ State _____ Zip _____

Phone _____ Fax _____

A. What is your primary job function/principal area of responsibility? (Check one)

- 1 ☐ MIS/DIP
2 ☐ Programmer/Systems Analyst
3 ☐ Administration/Management
4 ☐ Sales/Marketing
5 ☐ Engineer/Scientist
6 ☐ Other

B. What is your level of management responsibility?

- 7 ☐ Senior-level 9 ☐ Professional
8 ☐ Middle-level

C. Are you a reseller (VAR, VAD, Dealer, Consultant)?

- 10 ☐ Yes 11 ☐ No

D. What operating systems are you currently using? (Check all that apply)

- 12 ☐ PC/MS-DOS 15 ☐ Unix
13 ☐ DOS + Windows 16 ☐ MacOS
14 ☐ OS/2 17 ☐ VAX/VMS

E. For how many people do you influence the purchase of hardware or software?

- 18 ☐ 1-25 20 ☐ 51-99
19 ☐ 26-50 21 ☐ 100 or more

☐ Please send me one year of BYTE Magazine for \$24.95 and bill me. Offer valid in U.S. and possessions only.

February 1993

86 96 98

Product Category Information	Disks & Optical Drives	7	Multimedia	19	Educational	30	Shareware	42
	Diskettes/Duplicators	8	Printers/Plotters	20	Engineering/Scientific	31	Software Duplication	43
	Fax Boards/Machines	9	Programmable Hardware	21	Entertainment	32	Spreadsheets	44
Circle the numbers below for information on the entire category of products you're interested in.	Graphics Tablets/Mice/		Scanners/OCR/Digitizers	22	Graphics	33	Unix	45
	Pen Input	10	Tape Drives	23	Macintosh	34	Utilities	46
Hardware	Keyboards	11	UPS	24	Mail Order	35	Windows	47
Accessories/Supplies	LAN Hardware	12	Software		Mathematical/Statistical	36	Word Processing	48
Add-in Boards	Laptops & Notebooks	13	Business	25	Miscellaneous Software	37	General	
Bar Coding	Mail Order	14	CAD/CAM	26	On-Line Services	38	Books/Publications	49
Communications/Networking	Memory/Chips/Upgrades	15	Communications/Networking	27	Operating Systems	39	Recruitment	50
Computer Systems	Miscellaneous Hardware	16	Data Acquisition	28	Programming Languages/		Miscellaneous	51
Data Acquisition	Modems/Multiplexors	17	Database	29	Tools	40		
	Monitors & Terminals	18			Security	41		

Inquiry Numbers 52-233

52 78 104 130 156 182 208
53 79 105 131 157 183 209
54 80 106 132 158 184 210
55 81 107 133 159 185 211
56 82 108 134 160 186 212
57 83 109 135 161 187 213
58 84 110 136 162 188 214
59 85 111 137 163 189 215
60 86 112 138 164 190 216
61 87 113 139 165 191 217
62 88 114 140 166 192 218
63 89 115 141 167 193 219
64 90 116 142 168 194 220
65 91 117 143 169 195 221
66 92 118 144 170 196 222
67 93 119 145 171 197 223
68 94 120 146 172 198 224
69 95 121 147 173 199 225
70 96 122 148 174 200 226
71 97 123 149 175 201 227
72 98 124 150 176 202 228
73 99 125 151 177 203 229
74 100 126 152 178 204 230
75 101 127 153 179 205 231
76 102 128 154 180 206 232
77 103 129 155 181 207 233

Inquiry Numbers 409-590

409 435 461 487 513 539 565
410 436 462 488 514 540 566
411 437 463 489 515 541 567
412 438 464 490 516 542 568
413 439 465 491 517 543 569
414 440 466 492 518 544 570
415 441 467 493 519 545 571
416 442 468 494 520 546 572
417 443 469 495 521 547 573
418 444 470 496 522 548 574
419 445 471 497 523 549 575
420 446 472 498 524 550 576
421 447 473 499 525 551 577
422 448 474 500 526 552 578
423 449 475 501 527 553 579
424 450 476 502 528 554 580
425 451 477 503 529 555 581
426 452 478 504 530 556 582
427 453 479 505 531 557 583
428 454 480 506 532 558 584
429 455 481 507 533 559 585
430 456 482 508 534 560 586
431 457 483 509 535 561 587
432 458 484 510 536 562 588
433 459 485 511 537 563 589
434 460 486 512 538 564 590

Inquiry Numbers 766-947

766 792 818 844 870 896 922
767 793 819 845 871 897 923
768 794 820 846 872 898 924
769 795 821 847 873 899 925
770 796 822 848 874 900 926
771 797 823 849 875 901 927
772 798 824 850 876 902 928
773 799 825 851 877 903 929
774 800 826 852 878 904 930
775 801 827 853 879 905 931
776 802 828 854 880 906 932
777 803 829 855 881 907 933
778 804 830 856 882 908 934
779 805 831 857 883 909 935
780 806 832 858 884 910 936
781 807 833 859 885 911 937
782 808 834 860 886 912 938
783 809 835 861 887 913 939
784 810 836 862 888 914 940
785 811 837 863 889 915 941
786 812 838 864 890 916 942
787 813 839 865 891 917 943
788 814 840 866 892 918 944
789 815 841 867 893 919 945
790 816 842 868 894 920 946
791 817 843 869 895 921 947

Inquiry Numbers 1123-1304

1123 1149 1175 1201 1227 1253 1279
1124 1150 1176 1202 1228 1254 1280
1125 1151 1177 1203 1229 1255 1281
1126 1152 1178 1204 1230 1256 1282
1127 1153 1179 1205 1231 1257 1283
1128 1154 1180 1206 1232 1258 1284
1129 1155 1181 1207 1233 1259 1285
1130 1156 1182 1208 1234 1260 1286
1131 1157 1183 1209 1235 1261 1287
1132 1158 1184 1210 1236 1262 1288
1133 1159 1185 1211 1237 1263 1289
1134 1160 1186 1212 1238 1264 1290
1135 1161 1187 1213 1239 1265 1291
1136 1162 1188 1214 1240 1266 1292
1137 1163 1189 1215 1241 1267 1293
1138 1164 1190 1216 1242 1268 1294
1139 1165 1191 1217 1243 1269 1295
1140 1166 1192 1218 1244 1270 1296
1141 1167 1193 1219 1245 1271 1297
1142 1168 1194 1220 1246 1272 1298
1143 1169 1195 1221 1247 1273 1299
1144 1170 1196 1222 1248 1274 1300
1145 1171 1197 1223 1249 1275 1301
1146 1172 1198 1224 1250 1276 1302
1147 1173 1199 1225 1251 1277 1303
1148 1174 1200 1226 1252 1278 1304

Inquiry Numbers 234-408

234 259 284 309 334 359 384
235 260 285 310 335 360 385
236 261 286 311 336 361 386
237 262 287 312 337 362 387
238 263 288 313 338 363 388
239 264 289 314 339 364 389
240 265 290 315 340 365 390
241 266 291 316 341 366 391
242 267 292 317 342 367 392
243 268 293 318 343 368 393
244 269 294 319 344 369 394
245 270 295 320 345 370 395
246 271 296 321 346 371 396
247 272 297 322 347 372 397
248 273 298 323 348 373 398
249 274 299 324 349 374 399
250 275 300 325 350 375 400
251 276 301 326 351 376 401
252 277 302 327 352 377 402
253 278 303 328 353 378 403
254 279 304 329 354 379 404
255 280 305 330 355 380 405
256 281 306 331 356 381 406
257 282 307 332 357 382 407
258 283 308 333 358 383 408

Inquiry Numbers 591-765

591 616 641 666 691 716 741
592 617 642 667 692 717 742
593 618 643 668 693 718 743
594 619 644 669 694 719 744
595 620 645 670 695 720 745
596 621 646 671 696 721 746
597 622 647 672 697 722 747
598 623 648 673 698 723 748
599 624 649 674 699 724 749
600 625 650 675 700 725 750
601 626 651 676 701 726 751
602 627 652 677 702 727 752
603 628 653 678 703 728 753
604 629 654 679 704 729 754
605 630 655 680 705 730 755
606 631 656 681 706 731 756
607 632 657 682 707 732 757
608 633 658 683 708 733 758
609 634 659 684 709 734 759
610 635 660 685 710 735 760
611 636 661 686 711 736 761
612 637 662 687 712 737 762
613 638 663 688 713 738 763
614 639 664 689 714 739 764
615 640 665 690 715 740 765

Inquiry Numbers 948-1122

948 973 998 1023 1048 1073 1098
949 974 999 1024 1049 1074 1099
950 975 1000 1025 1050 1075 1100
951 976 1001 1026 1051 1076 1101
952 977 1002 1027 1052 1077 1102
953 978 1003 1028 1053 1078 1103
954 979 1004 1029 1054 1079 1104
955 980 1005 1030 1055 1080 1105
956 981 1006 1031 1056 1081 1106
957 982 1007 1032 1057 1082 1107
958 983 1008 1033 1058 1083 1108
959 984 1009 1034 1059 1084 1109
960 985 1010 1035 1060 1085 1110
961 986 1011 1036 1061 1086 1111
962 987 1012 1037 1062 1087 1112
963 988 1013 1038 1063 1088 1113
964 989 1014 1039 1064 1089 1114
965 990 1015 1040 1065 1090 1115
966 991 1016 1041 1066 1091 1116
967 992 1017 1042 1067 1092 1117
968 993 1018 1043 1068 1093 1118
969 994 1019 1044 1069 1094 1119
970 995 1020 1045 1070 1095 1120
971 996 1021 1046 1071 1096 1121
972 997 1022 1047 1072 1097 1122

Inquiry Numbers 1305-1479

1305 1330 1355 1380 1405 1430 1455
1306 1331 1356 1381 1406 1431 1456
1307 1332 1357 1382 1407 1432 1457
1308 1333 1358 1383 1408 1433 1458
1309 1334 1359 1384 1409 1434 1459
1310 1335 1360 1385 1410 1435 1460
1311 1336 1361 1386 1411 1436 1461
1312 1337 1362 1387 1412 1437 1462
1313 1338 1363 1388 1413 1438 1463
1314 1339 1364 1389 1414 1439 1464
1315 1340 1365 1390 1415 1440 1465
1316 1341 1366 1391 1416 1441 1466
1317 1342 1367 1392 1417 1442 1467
1318 1343 1368 1393 1418 1443 1468
1319 1344 1369 1394 1419 1444 1469
1320 1345 1370 1395 1420 1445 1470
1321 1346 1371 1396 1421 1446 1471
1322 1347 1372 1397 1422 1447 1472
1323 1348 1373 1398 1423 1448 1473
1324 1349 1374 1399 1424 1449 1474
1325 1350 1375 1400 1425 1450 1475
1326 1351 1376 1401 1426 1451 1476
1327 1352 1377 1402 1427 1452 1477
1328 1353 1378 1403 1428 1453 1478
1329 1354 1379 1404 1429 1454 1479

YOUR DIRECT LINK CARD

For free product information, mail your completed card today. For quicker response, fax to 1-413-637-4343!

See reverse side for card.

1. Circle the Numbers on Your Direct Link Card

Circle the numbers which are found on ads and articles in this issue or circle the product category number and receive information on all advertisers listed in that category.

2. Print Your Name and Address

Answer questions "A" through "E" and mail or fax card to 1-413-637-4343.

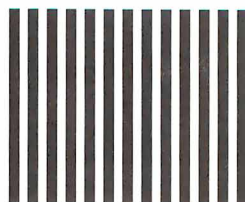
3. Product information will be rushed to you from the selected companies!

READER SERVICE
P.O. BOX 5110
Pittsfield, MA 01203-9926
USA

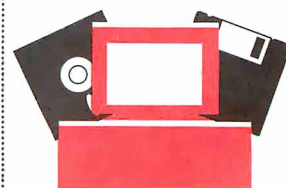
BYTE

POSTAGE WILL BE PAID BY ADDRESSEE

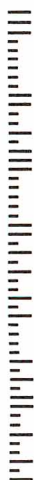
BUSINESS REPLY MAIL
FIRST CLASS MAIL PERMIT NO. 176 PITTSFIELD, MA



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES



BYTE 



Plugging into Wireless

The world of wireless and mobile computing includes telecommunications companies, computer manufacturers, hardware and software vendors, and service providers. The companies below represent a cross section of the eclectic wireless data communications industry.

Apple Computer, Inc.
20525 Mariani Ave.
Cupertino, CA 95014
(408) 996-1010
Makes the Newton PDA (Personal Digital Assistant).
Circle 1146 on Inquiry Card.

Ardis
300 Knightsbridge Pkwy.
Lincolnshire, IL 60069
(708) 913-1215
A joint venture of Motorola and IBM that provides large companies with nationwide wireless data communications.
Circle 1147 on Inquiry Card.

AT&T Microelectronics
Personal Communications Systems
4994 Patrick Henry Dr.
Santa Clara, CA 94954
(800) 372-2447 ext. 848
in Canada, (800) 553-2448 ext. 848
fax: (215) 778-4106
Produces the PCS chips for personal communicators, including the Hobbit processor.
Circle 1148 on Inquiry Card.

CDI (Cellular Data, Inc.)
2860 West Bayshore Rd.
Palo Alto, CA 94303
(415) 856-9800
Provides digital data transmission capability to cellular phone systems.
Circle 1149 on Inquiry Card.

Cue Network Corp.
2737 Campus Dr.
Irvine, CA 92715
(714) 752-9200
Provides one-way wireless E-mail connection for the Sharp Wizard.
Circle 1150 on Inquiry Card.

EO, Inc.
800A East Middlefield Rd.
Mountain View, CA 94043
(415) 903-8100
fax: (415) 903-8190
Markets the EO 440 and EO 880, personal communicators based on the AT&T/Go hardware/software platform.
Circle 1151 on Inquiry Card.

Ericsson GE Mobile Communications, Inc.
15 East Midland Ave.
Paramus, NJ 07652
(201) 265-6600
Markets the Mobidem, an RF modem for Mobitex networks.
Circle 1152 on Inquiry Card.

Ex Machina, Inc.
45 East 89th St., Suite 39A
New York, NY 10128
(718) 965-0309
fax: (718) 832-5465
Provides software link between paging receivers and Mac, DOS, and Windows computers.
Circle 1153 on Inquiry Card.

Go Corp.
919 East Hillsdale Blvd., Suite 400
Foster City, CA 94404
(415) 358-2000
fax: (415) 345-9833
Maker of the object-oriented PenPoint operating system.
Circle 1154 on Inquiry Card.

Granite Communications
9 Columbia Dr.
Amherst, NH 03031
(603) 881-8666
fax: (603) 881-4042
Produces in-building mobile wireless systems.
Circle 1155 on Inquiry Card.

Hewlett-Packard Co.
3000 Hanover St.
Palo Alto, CA 94304
(800) 752-0900
(415) 857-1501
Maker of the HP 95 line of hand-held computers.
Circle 1156 on Inquiry Card.

Individual, Inc.
84 Sherman St.
Cambridge, MA 02140
(800) 766-4224
(617) 354-2230
fax: (617) 354-6210
Supplier of the Heads Up information service for EMBARC.
Circle 1157 on Inquiry Card.

Mainstream Data
420 Chipeta Way, Suite 200
Salt Lake City, UT 84105
(801) 584-2800
Provides for FM and satellite reception of its news services.
Circle 1158 on Inquiry Card.

Microcom, Inc.
500 River Ridge Dr.
Norwood, MA 02062
(800) 822-8224
(617) 551-1000
fax: (617) 551-1021
Developers of MNP level 10, a data communications protocol for cellular communications, and makers of the MicroPorte portable modem.
Circle 1159 on Inquiry Card.

Motorola Paging and Wireless Data Group EMBARC/Motorola
1500 Northwest 22nd Ave.
Boynton Beach, FL 33426
(407) 364-2000
The Paging and Wireless Data Group produces the NewsStream information receivers. EMBARC provides a nationwide paging system that can connect to E-mail services.
Circle 1160 on Inquiry Card.

Motorola RadioWare Solutions Group
1201 East Wiley, Suite 103
Schaumburg, IL 60173
(800) 233-0877
(708) 632-4723
Produces WaveGuide 2.0, an API for Windows that lets developers create applications that can access the Ardis and RAM Mobile Data networks.
Circle 1161 on Inquiry Card.

Qualcomm, Inc.
10555 Sorrento Valley Rd.
San Diego, CA 92121
(619) 587-1121
Provides satellite-based data communications and developed CDMA (code division multiple access) technology for digital cellular communications.
Circle 1162 on Inquiry Card.

Radiomail
P.O. Box 1206
Menlo Park, CA 94026
(415) 326-5615
Provides gateway services between wireless communications systems and the wirebound data communications infrastructure.
Circle 1163 on Inquiry Card.

RAM Mobile Data
10 Woodbridge Center Dr., Suite 950
Woodbridge, NJ 07095
(908) 602-5500
fax: (908) 602-1262
A joint venture of RAM Broadcasting and BellSouth, it operates the wireless Mobitex-based RAM Mobile Data network in the U.S. and the U.K.
Circle 1164 on Inquiry Card.

SkyTel
1350 I St. NW
Washington, DC 20005
(202) 408-7444
Provides nationwide paging services.
Circle 1165 on Inquiry Card.

Zyxel USA
4920 East La Palma Ave.
Anaheim, CA 92807
(714) 693-0808
fax: (714) 693-0705
Manufactures cellular and standard modems.
Circle 1166 on Inquiry Card.

Inclusion in the resource guide should not be taken as a BYTE endorsement or recommendation. Likewise, omission from the guide should not be taken negatively. The information here was believed to be accurate at the time of writing, but BYTE cannot be responsible for omissions, errors, or changes that occur after compilation.

NETWORK FAX ON TAP

**Network fax servers
bring computer fax
to every desktop**

**RAYMOND GA CÔTÉ,
STEVE APIKI, AND
STAN WSZOLA**

Fax is the superhero among corporate communications channels—faster than overnight mail, more widespread than any E-mail system, and able to transmit graphics information with a single phone call. But it also has some serious flaws, like poor-quality scanned images, no security for incoming documents, and long lines at the fax machine (not to mention curly fax paper).

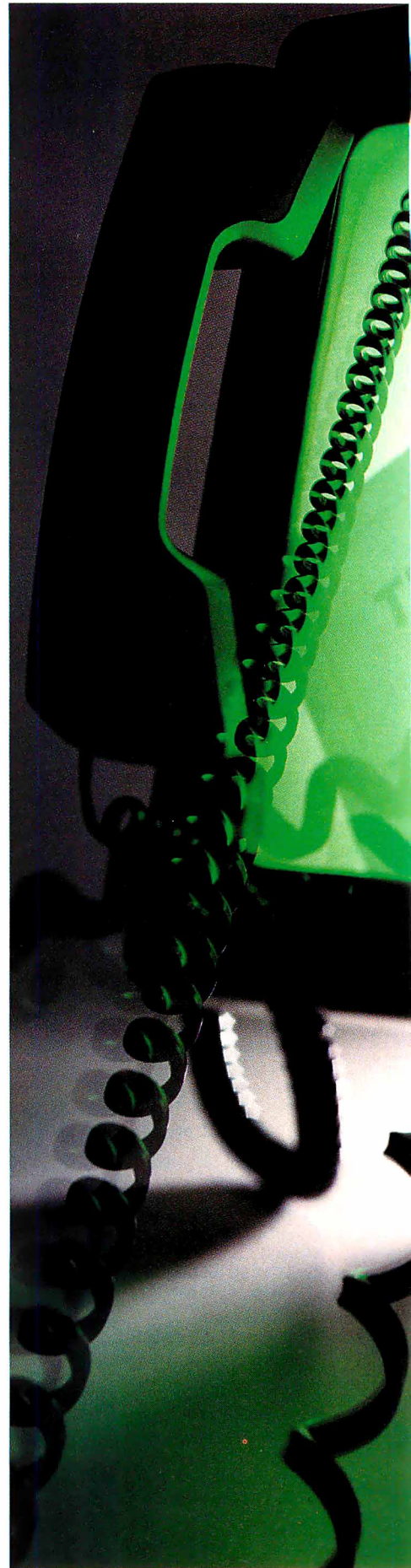
Computer-based fax has overcome a lot of these limitations, but there's still one area where the office fax machine enjoys a big advantage over a desktop fax system: Fax machines are shareable resources; desktop fax boards are not. Having one or two users who can send and receive faxes without leaving their desks doesn't replace a fax machine that used to serve the entire workgroup, regardless of the fax machine's frailties.

The solution, of course, is to tie together a LAN and a fax. This month's Solutions Focus looks at network fax servers, which promise to put a computer-based fax system (or at least a shared portion of one) on every desktop.

We'll look at 11 of the top players in the fax-server market for PC, Mac, and Unix networks: Alcom's LanFax Redirector 2.1, Calculus's Advanced EZ-Fax for Networks 3.53, Cheyenne Software's Faxserve 1.0, Intel's Net Satisfaction Software 2.0, OAZ Communications' NetFax 4.01, Optus Software's Facsys 3.30a, Pure Data's PureFax 3.1, Circuit Research's 4Sight Fax 2.0.3, STF Technologies' Faxstf Net 2.2.3, The Bristol Group's IsoFax 5.1, and Samsung Software America's Replix 1.0. (One familiar name, GammaLink's GammaNet, is not included—the company has abandoned its software products to focus on its hardware line.) Note that each of these is a computer-based system (i.e., they all require a dedicated or nondedicated host machine). In most cases, these systems are less expensive—if somewhat less extensible—than stand-alone fax servers, such as those from Biscom and Castelle.

Client-Server Faxing

From a network client, you use a fax server much as you would use a stand-alone computer fax board. Client utilities usually include printer drivers or print-capture





BYTE ACTION SUMMARY

■ WHAT FAX SERVERS ARE

Client-server software packages that share computer-based fax services among network users.

■ LIKES

Sharing a computer-based fax on a network saves money and countless hours compared to fax machines or a stand-alone computer-based fax; many packages integrate fax with E-mail.

■ DISLIKES

Routing incoming faxes to users is a problem that awaits a workable solution. Products are often difficult to install and administer, and no package has multiplatform support.

■ RECOMMENDATIONS

4Sight for Mac networks; Replix for Unix installations; and four PC-based packages with various strengths: LanFax Redirector, Net Satisfaction, Faxserve, and Facsys.

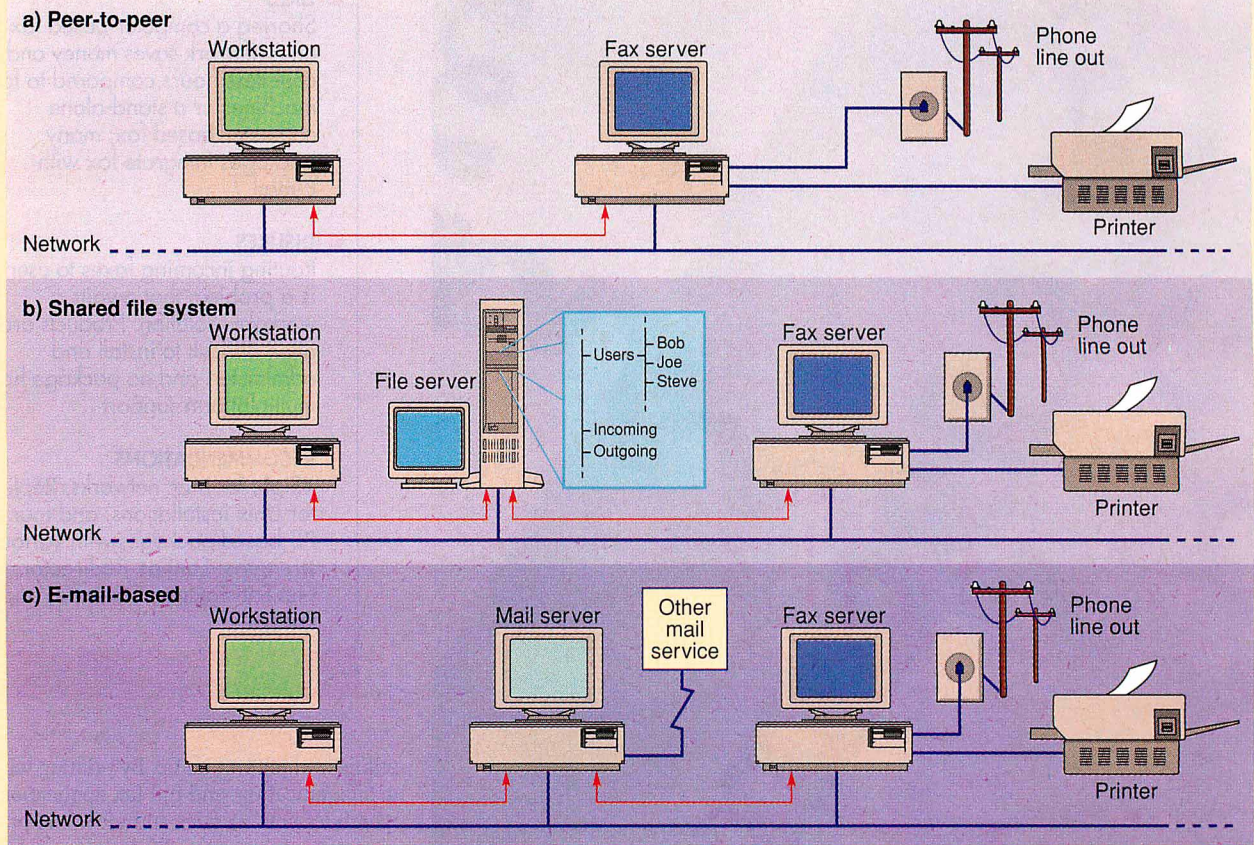
utilities, which let you fax by printing within an application, and full fax applications, which let you fax files and view and print incoming documents. Many also include command-line utilities for automating fax transactions or monitoring fax status.

Whatever the task, the client software executes it by passing along service requests to the fax server, which operates the hardware. Each communications link—between client application and client fax software, between client fax software and fax-server software, and between fax-server software and fax modem—relies on a fragile web of proprietary and standard protocols. The text box “Standards and Practices” on page 182 details some recent industry efforts to standardize communication between applications software and fax hardware for both network and stand-alone fax applications.

There are as many ways to implement a client-server fax system as there are fax servers on the market, but each package fits more or less into one of three configurations (see the figure). The first configuration is peer to peer. In this arrangement, fax-server and fax-client software communicate directly via network-transport protocols (e.g., Novell’s IPX). The benefits of this design are reduced file-server traffic and real-time client-server communication.

In the second configuration, the shared-

NETWORK FAX-SERVER CONFIGURATIONS



Three client-server organizations for network fax servers. (a) Peer-to-peer fax servers communicate with clients directly through network protocols. (b) A shared-directory design uses polling of a shared-file system on the file server for client-server communication. (c) E-mail-based fax servers get faxes from users and send received faxes back via standard mail transports.

file configuration, the fax server and the fax client communicate through reserved directory areas on a file server. For example, a client may write outgoing fax images to a directory called Outgoing on the file server. The fax server polls the directory and sends over the wire whatever files land in the Outgoing directory. The fax server may write incoming faxes to an Incoming directory and, once the faxes are identified, route them to individual user subdirectories. Client modules for each user poll the user directories for incoming faxes. This is a common configuration that makes for simple operation and reduces dependency on specific network operating systems.

The third fax-server configuration is mail-based and relies on E-mail as a transport between clients and server. Clients "mail" faxes for transmission, and the fax server mails incoming faxes to the appropriate user. This scheme works best if the

system in your office already relies on E-mail, providing a transparent link between these two methods of communication.

The Ins and Outs of Network Fax

Despite their differences, all 11 packages reviewed here provide LAN clients with three basic capabilities: image conversion, fax transmission, and fax reception. All consist of at least server and client software modules, and all require fax-modem hardware. In some cases, the fax modem is provided with the package (see the table for configuration details), but most require a fax modem in addition to the server software.

Transmitting an electronic fax requires at least two steps. First, the document must be converted into an electronic fax format. Second, it must be transmitted to the destination fax. Some systems perform both of these steps on the server, while others rely

on the client for image conversions. In some cases (most notably the Windows printer drivers), imaging is actually a two-step process; documents are converted to one format on the client and then reconverted to a fax format on the server.

All the PC-based packages take advantage of coprocessor-based fax-modem boards such as Intel's Net Satisfaction and GammaLink's GammaFax CP to reduce imaging time. These boards convert from ASCII text or bit-map image formats to a Group 3 byte stream without requiring work from the host processor. The Mac and Unix servers use external modems, and the host computer is responsible for all imaging.

Network fax servers' greatest weakness is in routing received faxes. Unfortunately, there is no standard method for specifying the addressee of a fax document through a shared fax system (although the CCITT is working on extending fax

A chain is as strong as its weakest link.

Picture your Hardlock™ key as a bike lock, and the accompanying software routines used to implement the copy protection as the chain. You can own the best lock that money can buy, but that lock is useless if the chain is weak.

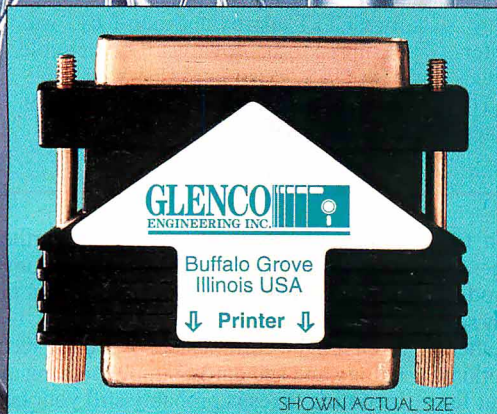
Introducing **HL-Crypt**, a major breakthrough in copy protection. HL-Crypt is not just a shell or simple conditional response checker. Using our proprietary Patcher Technology, HL-Crypt encrypts and binds the application to your Hardlock™ device. HL-Crypt features many protection modules that secure the application against piracy, reverse engineering, and debugging, to name a few.

Picture HL-Crypt as an ironclad chain. The only ironclad chain in the industry today. For more information, call

1-800-562-2543

HL-Crypt

**The Fortified Protection Linker
for Hardlock**



SHOWN ACTUAL SIZE

The only product that combines fortified software encryption with the Hardlock™ family of copy protection devices for single user and network implementation. Made in the USA.

For a distributor in Europe contact Fast Electronic GmbH, Tel: 49-89-539-800-20 Fax: 49-89-539-800-40
In Korea contact Finecom, Tel: 82-2-690-5811 Fax: 82-2-605-5729
In Brazil contact HY-MACH, Tel: 21-257-0914 Fax: 21-235-6808
In Chile contact Datasoft S.A., Tel: 662-246-7443 Fax: 562-208-0591
In Peru contact V.C.H.I., Tel: 51-14-440597 Fax: 51-14-475984
In Uruguay contact Softec, Tel: 90-60-10-92-30-08 Fax: 0598-2-92-16-18
In Australia contact Onstream Systems, Ltd., Tel: 64(08)-355-4100 Fax: 64(08)-358-1345

GLENCO ENGINEERING INC.
SERVING THE SOFTWARE INDUSTRY SINCE 1979

270 Lexington Drive
Buffalo Grove, IL 60089-6930
Phone 708/808-0300
Fax 708/808-0313

Standards and Practices

For software developers, the marriage of fax, computer, and LAN has been a difficult one. Unlike data communications, where there are standard methods for writing to hardware, there is no common starting point for working with fax modems.

In 1988, the CCITT TR29.2 standards committee accepted the Class 1 standard for communication between fax software and fax modems. The committee also voted on, but did not accept for technical reasons, the Class 2 standard. Software developers and fax-modem manufacturers decided to unofficially adopt Class 2 until the CCITT could develop an acceptable standard. In an effort to help define a standard, the EIA (Electronics Industry Association) has produced EIA TR.29, which encompasses Class 1, 2, and 3 command sets to standardize the use of fax modems and applications software.

Class 1, the only standard that has been officially issued, defines six commands that a computer can use to send a fax; for example, transmit or receive at 300 bps for parameter negotiations, and transmit or receive at 9600 bps for fax transmission. Class 1 fax software handles all the T.4 fax-image and T.30 session-protocol information and timing.

The Class 1 commands require the minimum amount of hardware to manipulate and send a fax. This means

that a Class 1 fax modem requires more CPU and system resources. Sending or receiving a fax with Class 1 fax modems and software typically means that active fax-conversion tasks can't run in the background.

Class 2 fax software generates a T.4 fax-page image and sends it to the fax modem a page at a time. The fax modem then handles the T.30 session-protocol information and timing. The de facto Class 2 commands provide 40 or more extended AT commands and responses to free up PC or server resources. If the Class 3 standard is ever issued, it will allow ASCII-to-fax or other file-to-fax conversion by modems.

PC APIs

For PCs, there are three defined methods for communicating with fax hardware: Intel/DCA's CAS (Communications Applications Specification), the FaxBIOS Association's FaxBIOS, and the CCITT's T.611 standard. All three are in contention for the title of standard API.

DCA and Intel released CAS in September 1988. CAS defined a standard communications API for working with Intel's Connection CoProcessor board and its successors, the Net Satisfaxtion series.

CAS is a high-level software interface for sending and receiving individual fax files and other binary files. The basic unit of transfer in the CAS inter-

face is an entire file. The CAS Resident Manager routines handle all the details of dialing, connection, file transmission, and call termination. Applications communicate with the Resident Manager, which handles everything in the background. The application and the Resident Manager communicate via control files, which record vital information about transmissions (e.g., phone numbers and transmit time). Unfortunately, CAS is not a network API and extending CAS across the network requires redirectors like those reviewed here.

FaxBIOS is an incompatible superset of the services provided by CAS. FaxBIOS is a high-level API designed for platform independence. It has all the capabilities of CAS, as well as networkwide enhancements. In addition, it has features for telephone directory management, graphics services, and low-level I/O-device control. FaxBIOS also incorporates a DDE interface for Windows.

Intel has not mentioned support for FaxBIOS, but it has announced support for a new API standard called T.Applecon, or T.611. The T.611 standard was developed by France's telephone company and has been submitted for CCITT approval. Since T.611 was designed to be downward-compatible with CAS, existing CAS-based applications will work on T.611 modems without modification.

addresses to include routing information). Most fax servers require an administrator to view incoming faxes and route them to users based on visual inspection. EZ-Fax and Faxstf do away with routing altogether by giving users access to all received documents.

However, several methods are available for automatic distribution. DID (Direct Inward Dial), which requires a service provided by the local telephone company, reserves a block of phone numbers for a single phone line. Through DID decoding hardware, the fax server knows which number was dialed and routes the fax to the designated recipient. LanFax Redirector, NetFax, Facsys, 4Sight, and IsoFax

all support DID when used with fax modems that provide DID decoding.

A somewhat less complex method of electronic routing uses DTMF signals sent after dialing to route a fax. However, there are no standard DTMF codes, and working effectively with DTMF requires that fax senders know to use the DTMF codes. Again, DTMF requires decoding hardware, which Net Satisfaxtion, Facsys, and 4Sight support.

Finally, Facsys offers an OCR routing capability. Facsys can scan the first page of a document, looking for a sequence of digits as a routing code. This capability suffers from the same drawbacks as DTMF, in that there is no standard method for in-

cluding numeric codes on a page. Further, it requires OCR to work reliably on sometimes poorly scanned documents from fax machines.

Given the current state of routing technology and standards, simply printing out incoming faxes is probably still your best bet. Except for Faxstf, all these packages offer the option of routing a copy of incoming faxes directly to a printer. For most packages, printing and routing via an administrator are the only methods we tried.

The Proving Ground

We tested each of these fax servers on a test network in the BYTE Lab. For the PC systems, we tested on a Novell NetWare

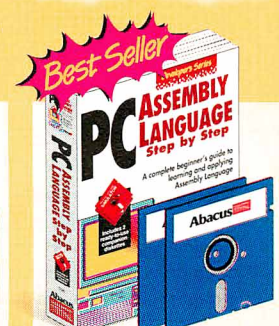
continued

PC INTERN

The encyclopedia of DOS programming know how for the professional programmer. Includes parallel working examples in Machine Language, C, Pascal and BASIC.

- DOS and BIOS internal structures and functions
- Programming video cards, sound, TSRs

#B145. ISBN 1-55755-145-6. Price \$59.95 with over 2mb of source code on one diskette. 1300 pages.



PC Assembly Language Step by Step

Teaches you machine language from the ground up, at your own pace. Learn assembly language using the unique assembly language simulator which shows how each instruction functions as the PC executes it. You'll get hands-on training with this exceptional book/disk combination.

#B096. ISBN 1-55755-096-4. Price \$34.95 with 2 5.25" companion diskettes.

Dep't B2

FAX-SERVER FEATURES

Many of the fax-server packages support a variety of third-party fax modems in addition to the hardware listed here. (● = yes; ○ = no; N/A = not applicable.)

	PC				
	Alcom LanFax Redirector 2.1	Calculus Advanced EZ-Fax for Networks 3.53	Cheyenne Faxserve 1.0	Intel Net Satisfaction Software 2.0	OAZ NetFax 4.01
Price					
10-user system	\$995	\$1399 ¹	\$995	\$1995	\$2490
50-user system	\$2995	\$1799	\$995	\$1995	\$2490
Unlimited	\$9995 ³	\$1799	\$995	\$1995	\$2490
Hardware included	○	●	○	○	●
Server platform	DOS	DOS	NetWare	DOS	DOS
Client platforms	DOS, Windows	DOS, Windows	DOS, Windows	DOS, Windows	DOS, Windows
Network support	NetWare, NetBIOS LANs	Any PC-based network	NetWare 3.10 and higher	NetWare	NetWare
Modem support	Class 2, CAS	Proprietary card	Class 2, CAS	CAS	Proprietary board
SENDING FAXES					
Input file formats	ASCII, PCX, DCX, PCL	ASCII, PCX, CUT, PCL, Group 3	PCX, DCX, BMP, PCL	ASCII, PCX, DCX	ASCII, PCL, TIFF, BMP, Group 3, OAZ fax
Print capture	●	●	●	●	●
Font support					
TrueType	●	●	●	●	●
PostScript	●	○	●	○	○
Windows	●	●	●	●	●
Macintosh	○	○	○	○	○
X Window System	○	○	○	○	○
Other	PCL	PCL	PCL	PCL, Epson FX	PCL
Phone books					
System phone books	●	○	○	○	●
User phone books	Within system phone book	●	●	●	●
Priority levels	2	2	○	○	○
Delay sending	●	●	●	●	●
Broadcast fax	●	●	●	●	●
Group faxes to one target	●	●	○	○	○
Fax imaged on client	●	●	●	●	●
Fax imaged on server	●	●	○	○	○
Auto-print outgoing faxes	●	○	○	○	○
Retransmit only unsent portion on retry	○	●	○	●	○
RECEIVING FAXES					
Routing					
Administrator	●	○	●	●	●
OCR	○	○	○	○	○
DID	●	○	○	○	●
DTMF	○	○	○	●	●
Auto-print incoming faxes	●	●	●	●	●
E-mail connections					
Unix mail	○	○	○	○	○
MHS	Option	○	●	○	●
cc:Mail	○	○	○	○	○
QuickMail	○	○	○	○	○
Microsoft Mail	○	○	○	○	○
Date/time stamp	●	●	●	●	●
Invert, size, scale received faxes	●	Windows client only	●	Invert only	Windows client only
Save as format	PCX, DCX, PCL	PCX, CUT	Fax only	Fax only	Fax only
OCR	○	○	○	○	○
ADMINISTRATION					
Administration platform	DOS, Windows	DOS, Windows	DOS, Windows	DOS, Windows	DOS
Transmission log	●	●	●	○	○
Receipt log	●	●	●	○	●
Export transaction log	●	○	●	●	○
Fax diagnostics	●	●	○	○	○
Privilege levels	User, router, admin.	None	User, admin.	User, admin., supervisor	User, admin., supervisor

Notes: ¹ Eight user

² Floating license

³ 250-user maximum

⁴ Requires DID

FAX-SERVER FEATURES

PC		MAC		UNIX	
Optus Facsys 3.30a	Pure Data PureFax 3.1	Circuit Research 4Sight Fax 2.0.3	STF Technologies Faxstf Net 2.23	The Bristol Group IsoFax 5.1	Samsung Software Replix 1.0
\$995 \$995 \$995 ○	\$699 \$699 \$699 ●	\$999 \$2749 \$4999 ○	\$249 \$249 \$249 ○	\$1990 \$3490 N/A ○	\$3293 ² \$6713 N/A ○
DOS	Windows	Macintosh	Macintosh	Solaris, AIX, HP-UX	HP 700, SCO Unix, Sun Sparcstation, IBM AIX
DOS, Windows NetWare	Windows Any PC-based network	Macintosh ○	Macintosh ○	Unix clients ○	Unix clients ○
Intel Satisfaction, others	Proprietary board	Class 1, Class 2, Apple Modem, FlexFax Modem	Class 1, Class 2, Apple Modem, Sierra SendFax	Class 2	Class 2
ASCII, PCX, DCX, PCL, PostScript ● ○ ● ● ○ ○ PCL	ASCII, TIFF, DCX, PCX, BMP, IMG ● ○ ● ○ ○ PCL	TIFF, EPSF, PICT, Paint ● ○ ○ ● ○ ○	TIFF, EPSF, PICT ● ● ○ ○ ○ ○	30 formats ● ○ ● ○ ○ ● ○	ASCII, PostScript, TIFF, XBM, PBM, MIF ● ○ ● ○ ○ ○ ○
○ ● 255 ● ● ○ ○ ● ● ○	○ ● ○ ● ○ ○ ○	● ● 2 ● ● ○ ●	● ● ○ ● ● ○ ●	● ● 2 ● ● ○ ○	● ● ○ ● ● ○ ○
○ ● ○ ○ ○ ●	○ ○ ● ○ ○ ●	○ ○ ○ ● ○ ●	○ ○ ○ ○ ○ ○	○ ○ ○ ○ ○ ○	○ ○ ○ ○ ○ ○
Windows client only BMP, PCX	IMG, TIFF, MSP, BMP, PCX	PICT, TIFF, Paint	PICT, TIFF, Paint	30 formats	TIFF, PostScript, PBM, XBM
○	○	Option	○	●	○
DOS, Windows	Windows	Macintosh	Macintosh	X Window System, command-line	X Window System, command-line
● ● ● ●	● ● ● ●	● ● ● ○	● ○ ● ●	○ ○ ○ ○	● ● ● ●
User, admin., router	User, admin., supervisor	User, admin.	User, admin.	User, admin.	User, admin.

3.11 network running over NE-2000 network cards on a Compaq Deskpro 66M server. Our standard fax server was a CompuAdd 433 system running DOS 5.0 and Windows 3.1 where appropriate. The Macintosh clients and servers ran on a Mac IIx and a Quadra 950 running System 7.0.1. All Unix testing was performed on a Sun Sparcstation 2 running SunOS 4.1.2 and Open Windows 3.

We used a wide range of fax modems. Many of the PC packages came with their own hardware; otherwise, we defaulted to an Intel Satisfaxion/200 board. We used external modems from Circuit Research and Dove Computer to test Mac fax servers and an Everex EverFax 24/96E (packages that claim Class 2 support all work with the EverFax modem).

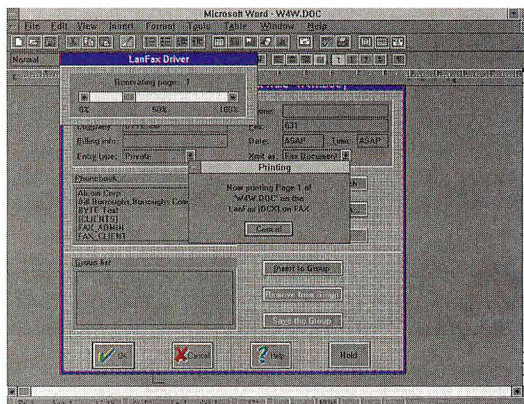
To test each server, we transmitted and received a variety of documents. Transmission test documents included a cover page with a bit-mapped BYTE logo, To/From fields, and a one-line message; a 4-KB text file; a full-page bit-mapped TIFF or PCX file; and, from the Windows PC and the Mac, a complex multicolumn Word document containing several fonts and images. For each, we noted the time it took and any difficulties in the transmission. For most packages, each transmission was instantaneous from a client perspective.

Besides the quantitative testing, we found that qualitative issues play a big part in determining the quality of fax servers. High-visibility items such as the flexibility of administration and routing tools, the client user interface, and the ease with which faxes could be automated are obviously important, but so are little items like cover-page customization, mixing graphics and text, and sharing user telephone-book databases.

Surprisingly, output fax quality is one area where we found little difference from one package to another. Even though you might expect text images created with TrueType or PostScript fonts to generate cleaner images, there isn't much noticeable difference with normal point sizes on a 200-dot-per-inch high-resolution fax. Graphics, too, showed little difference from fax server to fax server.

Unfortunately, none of these fax servers support clients on foreign operating systems, so you'll need to choose one that fits your current network platform. We've broken these products into groups based on operating systems in the following evaluations. Note that the mail-based packages (OAZ's NetFax and Circuit Research's 4Sight) and those that offer gateways to E-mail systems can offer some measure of fax interoperability between platforms.

Fax Servers for PCs



Software-only LanFax Redirector works with CAS hardware and third-party CAS applications. Client access runs through DOS or Windows utilities or through printer drivers, as shown.

LanFax Redirector 2.1

Alcom's LanFax Redirector does just what its name implies—it redirects CAS (Communications-Applications-Specification)-service requests from fax-client software to a dedicated fax server, using IPX/SPX or NetBIOS as a transport. Its clean architecture, combined with remarkably flexible DOS and Windows client software, makes LanFax Redirector one of the top picks in this review.

We tested LanFax Redirector with an Intel Satisfaxion Modem/200, but the software supports any CAS-compatible board, and it can handle up to eight modems in a single server. The CAS-centric approach brings with it some nice features, such as automatic handling of ASCII documents and the ability to send binary data to another CAS modem.

Installing LanFax Redirector is relatively painless. You install the board and run a utility that installs the server software and builds the system databases. Once it's up and running, the server collects CAS requests from clients and processes them through a CAS modem. It also maintains transaction records by user in a central system database administered through Borland's Paradox engine.

LanFax Redirector maintains its own list of authorized users, distinct from the network user list. But, you aren't forced to add users manually. You can configure server software to accept fax requests from any user and automatically add these users to the database. After this initial process, you can switch off the automatic-acceptance feature and manually tweak user rights.

Users may be administrators, users, or routers. Users deal only with their personal queues; routers can view the first page of any inbound fax and forward it to the appropriate queue. Unfortunately, routers can easily circumvent the first-page

feature simply by routing the fax to their personal queue and forwarding it later. If security is a critical issue, you can monitor the audit trail that LanFax Redirector maintains.

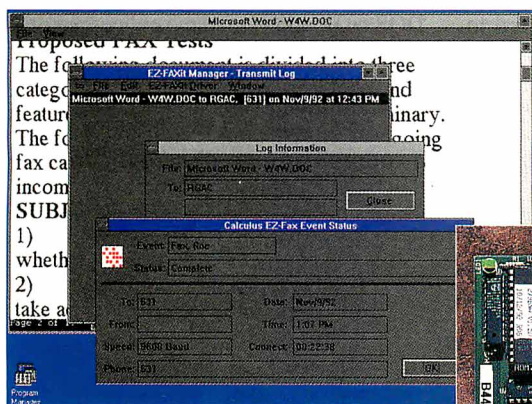
Users share a central phone book (again, a Paradox-compatible database). Entries are simply flagged as public, private, or shared. In contrast to those of the other packages, which require users to switch constantly between system and personal phone books, LanFax Redirector's phone-book structure is a real boon.

Users also share access to libraries—collections of preimagined faxes that are sent repeatedly (e.g., price lists); skipping the imaging process makes these fax quickly. However, LanFax Redirector's PCL (printer control language)-imaging engine is fast enough that you'll hardly notice the difference anyway.

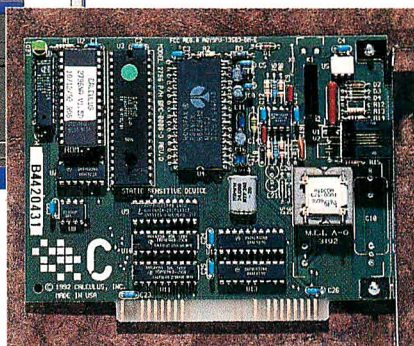
Alcom's software bundle includes DOS and Windows clients. Both require a redirection TSR program. The DOS utilities include a print-capture TSR and the menu-driven Fax Manager. Fax Manager can be used to transmit PCX, ASCII, and fax files; view user status; and receive documents.

Windows utilities include a fax printer driver and a nice, Borland-style menuing system for managing fax documents. If you're a Windows user, you can easily select cover-page logos and attachment files. However, as with all CAS-based packages, you aren't free to rearrange the position of address and logo information on the cover page. The Windows printer driver includes a handy Hold feature that lets you tack documents from multiple applications into a single fax. If you need to fax a spreadsheet and a letter, you just choose Hold after printing from Excel, print to the same driver from WordPerfect for Windows, and then release the fax.

If you require E-mail integration, you can get it through an optional MHS (Message Handling Service) gateway (\$3595), which we didn't test. The bundle we did test lists at \$2995 (without hardware) for a 50-user system.



EZ-Fax for Networks bundles a fax-modem card (with scanner support) and network software in an easy-to-use package.



Advanced EZ-Fax for Networks 3.53

Calculus's Advanced EZ-Fax comes closer to the model of an actual shared fax machine than do any of the other servers. Like real fax machines, it includes built-in scanner support for sending paper documents and doesn't require a dedicated PC to service fax requests. But on the downside, EZ-Fax also lacks security features, easily configured cover pages, and E-mail integration. EZ-Fax includes a fax-modem/scanner card and server software, as well as Windows and DOS client utilities, for \$1799 for a 10- or 50-user system.

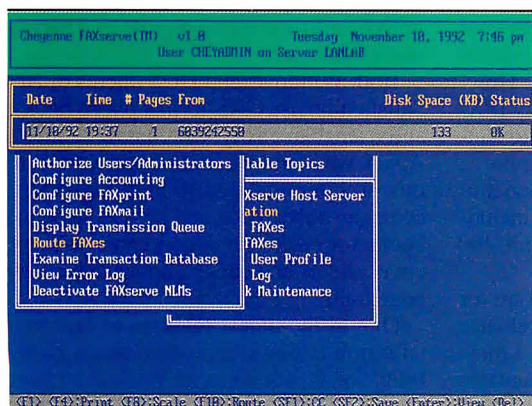
EZ-Fax relies on a simple shared-directory structure. It works with any PC-based network that lets you export directories, including peer LANs. Because there are no security features, there are no user IDs to maintain, no privilege levels, and no routing. Every user has access to every inbound fax, and every user with access to client software and the shared directory can transmit faxes.

The EZ-Fax server is a nondedicated machine that runs a background process that requires 166 KB of conventional memory (considerably less with EMS). One user can continue to use the EZ-Fax server for other tasks, but the background process will occasionally take over the machine for file conversion. In practice, we found that the fax-server machine probably shouldn't be used for much more than light word processing.

Client software has print-redirection utilities and menu-driven DOS and Windows programs. When you launch a print job with an EZ-Fax print-capture utility installed, you can choose between faxing and printing; thus, you can leave the redirectors installed at all times and don't have to bother installing or uninstalling them.

With the Calculus Windows Fax Manager, you can view both transmit and receive logs or maintain phone books (each user can have multiple phone books). However, you can't simply fax a file from within the Windows fax manager. Calculus licenses the manager from Alien Computing, so if you know Faxit, you'll find it familiar going.

EZ-Fax makes heavy use of tags in text files for embedding graphics. You can define cover sheets with this method or attach preimagined files to local faxes.



As expected, NLM-based Faxserve's NetWare integration is very good. Client tools, shown here, provide a familiar NetWare-like C-Worthy interface to the fax server.

Obviously, this exacts an additional processing toll on your file server; however, we didn't find that it added much of a strain on our test network. Since file servers are so often

server. Installation is easy and includes copying DOS and Windows client software to the network. Installing Faxserve generates a new NetWare user, named faxserve, on the server you select, which the Faxserve NLM uses for access to print queues and other NetWare services.

Naturally, Faxserve's integration with NetWare is tight. When you bring up Faxserve for the first time, you can pull users out of the NetWare bindery into Faxserve's user list, configuring users as either administrators or users. It's worth stressing that Faxserve's user list is distinct from NetWare's, and you are required to maintain user lists for both entities.

By default, Faxserve uses NetWare's Mail directory structure for storing custom user files. This includes (CAS format) user phone books and custom cover-sheet logos. Faxserve DOS clients can switch between phone books, so we arranged for Faxserve clients to have access to both a central phone book and custom user versions. Windows clients maintain their own phone books in non-CAS format. The method for switching Windows phone books is clumsy—users need to change phone books in a configuration menu that's unrelated to sending and receiving.

continued

Faxserve 1.0

One significant cost in building a network fax solution is the price of dedicating a high-powered workstation to the task of sending and receiving faxes. If you run a NetWare LAN, Cheyenne's NLM (NetWare loadable module)-based Faxserve provides an attractive alternative.

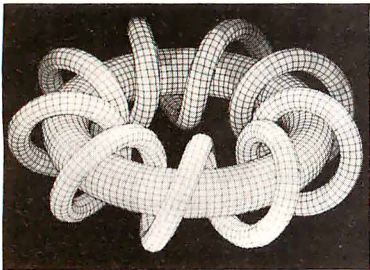
Faxserve is the first (and so far the only) network fax server built as a collection of NetWare NLMs. With Faxserve, you install the fax-modem card in the file server, eliminating the need for extra hardware.

limited by I/O requirements rather than by CPU horsepower, we expect our experience will be typical among Faxserve users.

Faxserve works with CAS applications using shared directories. Faxserve can also route faxes through MHS with FAXMAIL.NLM, a second module bundled with the package. Faxserve sells for \$995, including mail support and DOS and Windows clients. We ran Faxserve with an Intel Satisfaxion Modem/200.

You install Faxserve from a client workstation and then load the NLMs on the file

Gain speed in your problem solving and confidence in your answers with Maple V...



3-D Tube Plot created with Maple V.

The symbolic math software for engineering, science, and education professionals.

Maple, developed at the University of Waterloo, is today's most complete symbolic math package, and it's now available from MathSoft, the makers of Mathcad. Maple's comprehensive library of over 2,000 built-in functions and easy-to-use interactive environment delivers a maximum strength program in a surprisingly uncomplicated package.

• Provides power and flexibility.

You won't believe that something so powerful runs on everything from supercomputers to computers with as little as 1MB of memory. And Maple's flexibility makes it easy to share files across all platforms. It's completely programmable... and Maple's user interface supports natural mathematical calculations, so you can request an infinite variety of computations and graph your output in two or three dimensions.

• Use for a wide range of applications.

Maple is ideal for a wide range of applications, including helicopter blade design, VLSI design, chemistry, satellite guidance systems, econometrics, electrical engineering, and applied mathematics — to name just a few. Maple frees you from the "bookkeeping" of complex calculations and lets you concentrate on modeling and problem solving.

Call us toll-free at 800-628-4223 or use this coupon to request more information on Maple.

In Massachusetts call 617-577-1017 or fax this coupon to 617-577-8829.

[] Yes! Tell me more about Maple.

Name

Title

Company or institution

Address

City State Zip

Phone ()

Mail this coupon to:
MathSoft, Inc.
201 Broadway
Cambridge, MA 02139
USA

B95

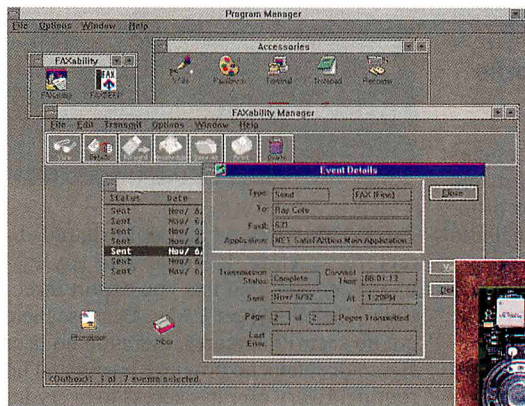
Maple

FAX SERVERS

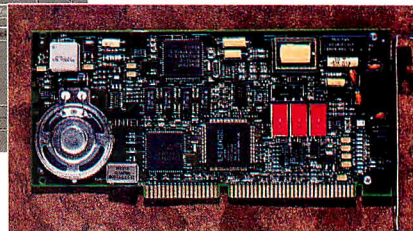
Incoming faxes arrive in a central location. Users with administrator access privileges must view and route faxes manually, although you can set up Faxserve to automatically print incoming faxes to a printer on the file server or on any NetWare queue. Once the administrator has routed a fax, it lands in the addressee's mail directory.

You can send a fax through print-capture drivers or menu-driven utilities from

DOS or Windows, and the utilities are easy enough to work with. But, you can't fax files directly from DOS clients; you must work through print capture. DOS client software and the installation and management utilities use a C-Worthy interface that will be familiar to any NetWare user. Cheyenne's Windows FaxClient manager is licensed from Alien Computing and bears a striking resemblance to the one provided by Calculus with EZ-Fax.



Faxability, Intel's Windows client, provides a nice MDI that's easy to get around in. We tested Net Satisfaction with Intel's Satisfaction Modem/200 in the server.



Net Satisfaction Software 2.0 and Satisfaction Modem/200

Intel's Net Satisfaction is similar in architecture to Alcom's LanFax Redirector. Net Satisfaction is a CAS redirector that funnels client CAS service requests to a dedicated CAS-based server. However, Net Satisfaction supports only IPX/SPX as a transport, so it's limited to NetWare LANs. Net Satisfaction supports, but does not include, any Satisfaction modem; the software sells for \$1995, including clients. The Satisfaction Modem/200 costs \$369.

Net Satisfaction relies on NetWare for its transport, so it can afford some reliance on NetWare user information. Like most other packages, Net Satisfaction maintains its own user list, but you can pull users directly out of the NetWare bindery into Net Satisfaction. However, you will need to manually set some user access rights and set up the system log-in script to personalize each user's installation. In Net Satisfaction, users can have normal privileges or be designated as administrators or supervisors. As with LanFax Redirector, administrators can view first pages and route faxes. Supervisors can configure accounts.

Net Satisfaction includes DOS and Windows client software. Both clients require that users run a CAS redirection TSR. DOS clients can then choose between a print-

capture TSR, a menu-based send/receive and status-inquiry program, and administrative utilities. Using the DOS TSRs is straightforward.

Both Windows and DOS clients of Net Satisfaction use CAS-format phone books, and users can easily switch among them. Again, we found the best way to work with this architecture was to create a shared company phone book and individual phone books for each user. Users can also tailor cover sheets and easily choose the cover-page logo.

One of the nicest features of Net Satisfaction is that it includes Intel's Faxability for Windows as its Windows client module. Faxability features the best user interface among Windows clients we have seen. It is simple to navigate and has toolbar icons that are refreshingly obvious. Faxability has MDI (Multiple Document Interface) windows (with cute icons) for the inbound fax log, outbound fax log, and user telephone book. In addition, faxability is the easiest and most usable package when it comes to customizing the cover page. Between these features and the toolbar, Faxability beats the other Windows fax clients hands-down. Faxability also includes a CAS-based printer driver for printing from within applications.

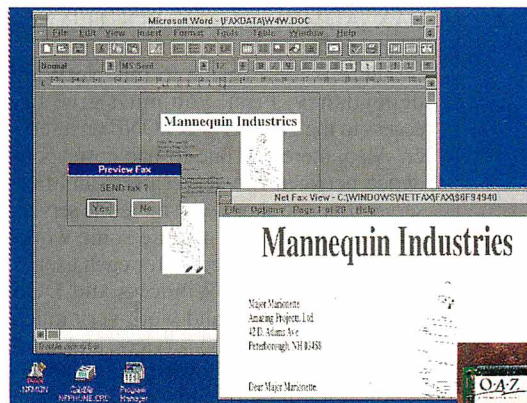
NetFax 4.01

E-mail, an option for many of these packages, provides the foundation for OAZ Communications' NetFax. NetFax uses Novell's MHS as a transport between fax-client stations and a dedicated server, which forms a gateway between MHS mail and fax. NetFax includes server software, a proprietary fax-modem board, and DOS and Windows clients for \$2490. A NetWare network running MHS is required.

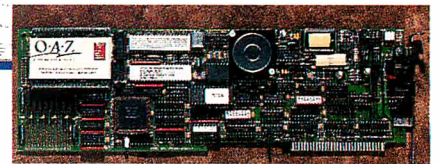
NetFax works by creating an MHS user ID for the fax server. Once this is in place, users mail fax messages to the fax server, and the fax server mails received faxes back to users.

Once we got NetFax installed, we found it robust and relatively easy to use from a client perspective. However, installing the package was a nightmare. Even though it comes with an automatic installation script, changing a default parameter (i.e., the MHS user name for the server) caused the script to update the name in some parts of the program but not in others, and it wouldn't work properly. We went through the installation process several times.

Authorized NetFax users are a subset of the users with MHS addresses. At installation time, you can pull NetFax user information out of the NetWare bindery, and the utility also builds the MHS directory structure from user names in the bindery. There are no separate NetFax privilege levels, and this sidesteps most management issues. However, if you want fax security, you'll need to assign NetWare permissions manually to the incom-



OAZ's client component puts a Windows face on NetFax, an E-mail-oriented fax server that runs on Novell's MHS. NetFax also includes a proprietary fax modem.



ing message directory.

If you have an MHS-compatible mail system, you can use it to mail fax messages to the mail server. Faxes are always sent as cover letters, with additional sheets and documents sent as attachments. You specify phone numbers and other fax-specific information as part of the address line, or you can embed this information with command tags. Mail users receive faxes through MHS and can use NetFax client software to view and print faxes. If you aren't running an MHS-compatible mail system, NetFax includes a basic mail package as part of its DOS client software.

The DOS client software also includes a print-capture utility. If you use a third-party mail system as a transport, however, you can't fax directly from within applications; you'll need to capture printer output to a file before using the mail system to mail it (unless the mail system itself supports print capture). DOS users share a

systemwide phone book (to which each user can add private entries) and a systemwide logo file.

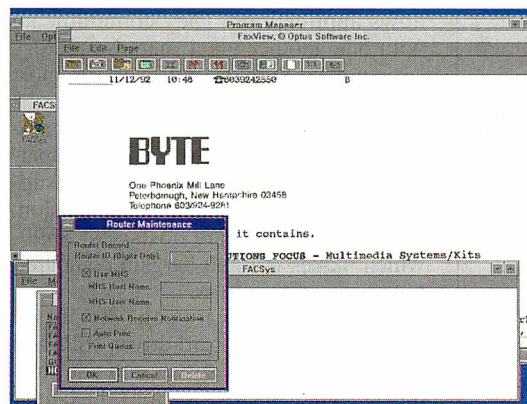
The OAZ Windows client component also works through MHS, and it includes print capture and a stand-alone utility. Both of these hook into the mail-monitoring program via DDE; the monitoring program alerts you to fax events with a blinking icon. Windows phone-book information is kept in a local card file, which provides a nice interface, but this design isolates the Windows phone book from the system phone book provided by the NetFax server.

For inbound faxes, NetFax supports DTMF routing in the standard package. If you don't use DTMF, an administrative user can route faxes via mail from a central directory.

Facsys 3.30a

Unlike many of these packages, which come with enough disks and documentation to make a C compiler feel at home, software-only Facsys from Optus Software comes on a single disk accompanied by a pocket-size manual. The documentation is spotty in places, but Facsys itself is among the most robust, full-featured fax servers in this review.

Facsys consists of a dedicated server that communicates via NetWare protocols, shared directories, and NetWare print queues with fax-client nodes on the network. Facsys is not CAS-specific; in addition to Intel's Satisfaction board, Facsys supports the GammaFax board and a few others. However, Optus provides redirection shells (which we didn't test) for supporting CAS and FaxBIOS client applications. Facsys also includes MHS-gateway services for working with E-mail



Facsys includes several unique features, including an OCR routing capability that lets you route incoming faxes based on a numeric ID on the cover page.

packages. The bundle costs \$995.

Installing Facsys was simple. The installation program creates a NetWare print queue and sets the fax server as the NetWare print server. In effect, the Facsys print queue (PRINTQ_FAX) acts as a direct "fax queue." In addition, the installer

creates NetWare groups FAX_ADMIN and FAX_ROUTER, which correspond to Facsys privilege levels. As the NetWare administrator, you simply need to configure a print job for the print queue.

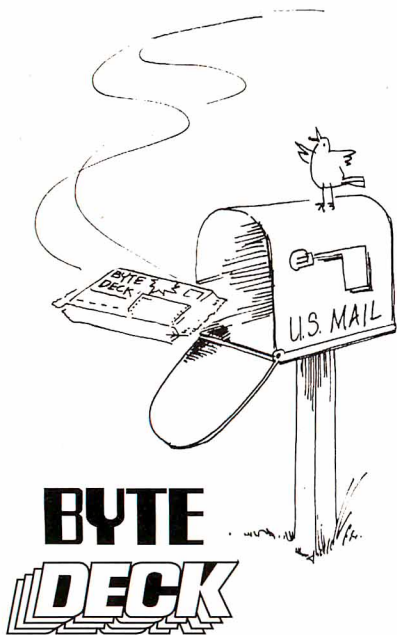
Facsys provides the best NetWare integration of any of these packages. NetWare users are Facsys users; there is no separate name space to keep track of. By default, the NetWare group EVERYONE has access to Facsys services. To set Facsys privilege levels, you add users to the

Attention U.S. BYTE Subscribers

Watch for the next BYTE DECK mailing that will be arriving in your mailbox soon!

Use this as a fast, convenient tool to purchase computer products and services. It's loaded with essential hardware and software products that you should be aware of when making your buying decisions. . .and it's absolutely FREE!

If you have a computer product or service, and would like to reach 275,000 influential BYTE magazine subscribers, please give Brad Dixon a call today at (603) 924-2596.



BYTE DECK

Here's what a BYTE Deck advertiser has to say:

"The BYTE Deck consistently performs for us, that's why we've been an advertiser for over two years!"

Karen Tacy, Marketing Manager
Rainbow Technologies, Irvine, CA

FAX SERVERS

FAX_ADMIN and FAX_ROUTER NetWare groups.

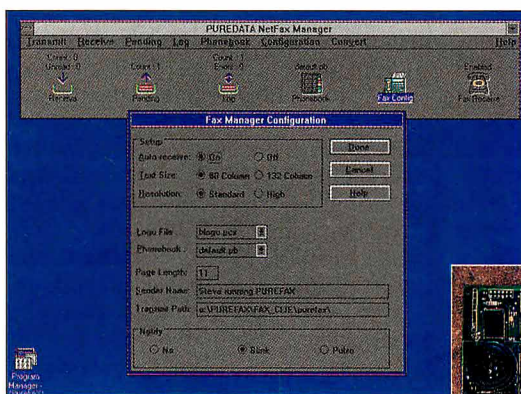
There is a downside to this NetWare dependency. First, you must give fax access to the group EVERYONE on a server. Also, there is a one-to-one correspondence between file-server users and fax-server users, so shops with more file servers than fax servers will require some workarounds to provide access for each user.

Facsys provides Windows and DOS clients (which look and work very much alike), print-redirection services, and command-line utilities. Cover-page customization is a little inflexible; while you can install different default logos, you can't choose a logo for each fax.

You can switch the print redirectors be-

tween PRINTQ_FAX and local or other queued printers on the fly (as you can with the printer drivers that Calculus provides)—this means that you can leave the redirectors installed at all times and don't have to bother installing or uninstalling them. Users can also print directly to PRINTQ_FAX using PCL escape sequences for embedding phone numbers and other fax-specific information.

Incoming faxes can be manually routed, or you can use Facsys's OCR routing capability. The OCR engine scans the first page of each inbound document for a numeric string. We have seen it work; however, OCR is still a little too finicky for us to recommend using it on a regular basis.



PureFax 3.1

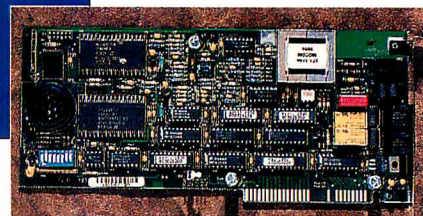
Pure Data's PureFax is a pure Windows solution to the problem of faxing on PC LANs. Both PureFax's client software and its dedicated server program are Windows applications. They communicate with one another via a shared-directory structure, so PureFax will work on most any LAN operating system.

PureFax comes with its own fax modem, a Pure Data PD19614 CAS-compatible board. The fax modem includes support for data, as well as fax transmission. Modem and software costs just \$699, which makes it a real bargain compared to the other fax servers.

The server software consists of two modules: Faxres (a board-driver TSR) and Faxsuper (the main server and administrative Windows application). Faxsuper lets you define system parameters and user information. Faxsuper is well designed for use with NetWare, and you can put user information from the NetWare bindery into the PureFax user list.

Each PureFax user gets his or her own directory. The directory holds directed faxes, as well as user phone books and lo-

PureFax is a Windows network fax server; both client- and server-software modules are Windows-hosted. The fax modem (included in the package) can run in a dedicated or a nondedicated server.



gos. As with other CAS-based products, you can switch between phone books at will.

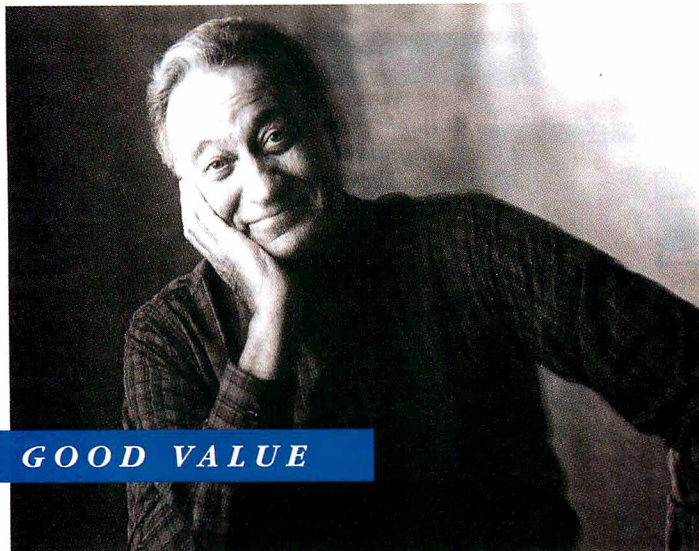
PureFax users all share a common privilege level. There are no administrator- or router-class users. Instead, PureFax designates the user of the system console (i.e., Faxsuper, the application running on the server) as the administrative user. The Faxsuper user can configure the system (with the proper password) or view the first page of any document and route it to the appropriate user. Alternatively, you can have PureFax print every incoming fax or route every fax to a single user.

The ability to route faxes extends to anyone with access to Faxsuper. However, you can modify the system configuration only by getting into Faxsuper's password-protected Supervisor mode.

Windows clients can run a Windows application or print through a Windows printer driver. The Windows application provides a nice user interface, and we discovered sending and receiving faxes to be straightforward with PureFax.

continued

"Sure, I remember my first modem..."



"My first modem? It was a cheap thrill. And that impulsiveness really cost me. Now I know better. The DataPort 14.4 Data/Fax Modem gives me real value; even puts money in my pocket!"

Now I Know Better."

THE NEW AT&T DATAPORT™ 14.4/FAX MODEM

Introducing the powerful, robust V.32bis DataPort 14.4/Fax Modem. It pays for itself by significantly reducing your long distance costs—and features fax capability, too! For IBM PC/AT/XT and Macintosh, it:

- Sends/receives text, data, and images
- Links PCs to PCs, fax machines, and mainframes anywhere in the world
- Transfers data files; exchanges images with fax machines
- Accesses E-mail, bulletin boards, and information services

THRILLING, AND PAYS FOR ITSELF

It's all in the technique. The DataPort 14.4/Fax Modem features AT&T's exclusive, new *Optical phone Line Interface (OLI)*, pat. pending; and V.42bis data compression and error correction. It excels in performance, especially on extremely weak "real world" lines!

This faster transmission, with effective throughput of up to 57,600 bps, significantly reduces your long distance costs. And it improves your productivity—no more waiting for your screen to refresh; no standing in line to send faxes.

YOU INHERIT AT&T VALUE

Designed by AT&T Bell Labs and AT&T Paradyne with built-in reliability and the industry's widest compatibility—tested and proven. And only AT&T gives you a lifetime warranty and toll-free technical support for as long as you own your DataPort family product!

READY TO GET SERIOUS?

From just \$415 suggested retail! 5 models to meet your exact needs for price, speed, features, and functions: the DataPort 14.4/Fax Modem and DataPort 9.6/Fax Modem, in standalone and PC-internal card models; and the DataPort 14.4 Modem standalone.



Proudly made by AT&T Paradyne in the U.S.A.

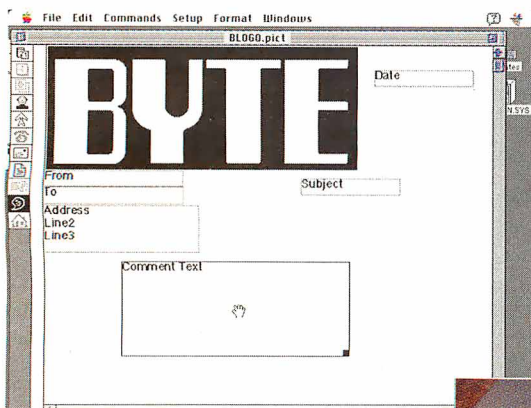
For more information on the DataPort family or the name of the dealer nearest you—call us at 1 800 554-4996 ext. 96.

SOLIDLY-BUILT, SOLIDLY-BACKED BY AT&T



Circle 158 on Inquiry Card (RESELLERS: 159).

Fax Servers for Macs



4Sight provides a highly configurable cover page. The background is a PICT image; the foreground contains fields to be filled in at fax time. You can move and resize each of the fields using a mouse.

4Sight 2.0.3

This is industrial-strength faxing for the Macintosh. Circuit Research's 4Sight, a \$2749 package (for 50 users), simplifies the administration and tracking of large numbers of users with high-volume fax requirements. 4Sight supports multiple servers within a network and multiple fax modems per server. Individual fax lines can be dedicated for incoming or urgent-only faxes.

4Sight's server communicates with its clients through E-mail—either through the built-in 4-Link or through Microsoft Mail or CE QuickMail. This removes the need to have an AppleShare server on the network for exchanging files. In addition, the fax server does not need to be a dedi-



cated machine. When an application creates a fax, the client printer driver spools an intermediary-format file to disk and launches the 4-Link DA (desk accessory). (You can also use the 4-Link DA for composing stand-alone faxes.) At this point, you've constructed a mailable package that has a single enclosure (the document you just printed). To this, you add a cover sheet with the destination and possibly more documents (e.g., previously built fax images, text files, and PICT images). You can preview any of these file formats.

This package is mailed to the server, which images the cover sheet and trans-

lates the data into final fax format. Although this procedure returns control to the client workstation quickly, the fax itself can take a while to begin transmitting. Most of the packages we tested took 2 or 3 minutes to begin transmitting a complex Word document; 4Sight took over 6 minutes.

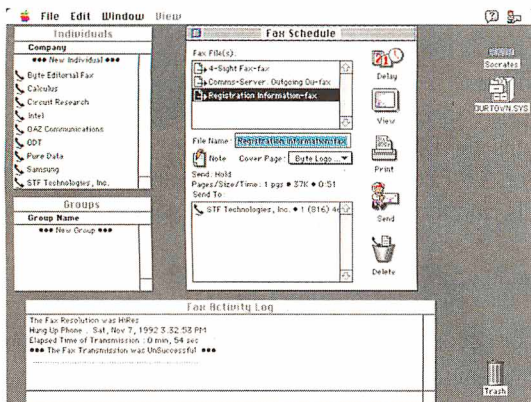
4Sight gives you complete control over cover-page layout. You can specify the size and location of the logo and any text field.

4Sight has its own list of authorized users, but the administrator can let 4Sight automatically add each LAN client the first time he or she attempts a fax transmission. Phone books are stored as tab-delimited files that can be easily manipulated by other programs.

Administrators can choose to select a new folder every day, week, or month, into which all archived faxes and logs are stored. This greatly simplifies administration of accounting and off-site archiving.

One minor drawback to 4Sight is its reliance on a particular modem in each of the countries it's sold in. The parent publisher, U.K.-based 4Sight, certifies a fax modem in each country. In the U.S., the modem is the FlexFax from Circuit Research. Circuit Research sells the bundle we tested. Among the features of the FlexFax modem is a large on-board buffer that can improve server throughput when controlling several modems.

Overall, 4Sight blends the strength of a GUI with the industrial guts required for a high-volume faxing environment. If you've got high-volume requirements on a Mac, get 4Sight.



A Faxstf administrator session showing phone books for individuals and groups. Fax status is dynamically updated and shows the state of the fax transmission queue.

package (\$249) provides fax services to all users (up to the limit of your AppleShare server) within a single network zone. Additional licenses are required for each zone in your

organization.

The user interface is simple and intuitive. Although not as flexible as 4Sight, Faxstf lets you design cover pages quickly by pasting graphics into a template image. You copy a graphics image from a paint or draw program and paste it into a new or existing cover-page template. Text

on the cover page is represented by a gray box that you can drag around for proper positioning.

You choose destinations by dragging names from the phone book into a destination box. In addition, you can send short notes of up to 255 characters using the Quickfax DA.

A printer driver redirects the output from any application to the fax server. You can choose the fax printer driver permanently from the standard Mac Chooser or temporarily through a user-configurable hot-key sequence. The hot key turns the normal Print and Printer Setup entries in the File menu into Fax and Fax Setup. If any other program (e.g., terminal emulation) tries to get hold of the serial port while Faxstf has control, the fax package relinquishes control until the other program terminates. We found this printer-driver interface the best of any of the packages we tested.

Shared files on the AppleShare server provide communication between users and

Faxstf Net 2.2.3

STF Technologies' Faxstf Net, a shared-file fax server, requires an AppleShare server for client/fax-server communication. You can run Faxstf on a nondedicated Mac, but STF recommends dedicating a server for heavy loads. The low-cost

Have You Ever Wanted To Leap Out The Nearest Window?

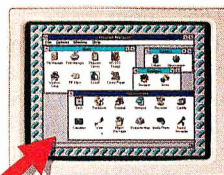
Take The Plunge With Proxy. It's Network Remote Control For Windows, From Windows.

Some things you expect in remote control software. Like lightning-fast speed. And control over both DOS and Windows on the host PC. But new Proxy gives you something you probably don't expect. Because it not only works with Windows, it works from Windows. And that makes all the difference.

You see, other remote control products run from DOS, even



If it runs on the host, it runs in a Proxy window. Even graphical DOS programs.



Proxy supports host computers running Windows.

No need to abandon your own work when someone calls. Just click on a Proxy icon and instantly connect to the caller's machine. You now have full control of their hardware and software, complete with mouse and keyboard support, whether

they're running Windows or DOS.

Reconfiguring Lots of Workstations? Leap Out The Nearest Window.

Now you can perform administrative chores like software installation, updates, and system configuration without going from room to room. Just capture a PC and perform any operation as if you were sitting in front of it.

You can even reboot it remotely!



Proxy gives you complete control of any computer on the network.

Need More Processing Power? Leap Out The Nearest Window.

Imagine off-loading your most CPU-intensive tasks to separate machines you control as if they were part of your own desktop. Imagine two, three, or more applications, each running at full speed because each has its own dedicated processor. That's the power of multi-processing with Proxy.

You can make Proxy available across the network and give power-hungry users access to spare or idle PCs. You can even dedicate PCs to specific tasks, like a high-powered 486 for CAD or a modem-equipped 286 for communications.

Take The Next Logical Leap in Remote Control.

Get the most advanced network remote control available, with applications ranging from user support to multi-processing. Get Proxy. It's from Funk Software. The same people who brought you Sideways®, Allways, and other top-selling PC utilities.

Call today to order or for more information.

1-800-828-4146 Ext. 802 (U.S. and Canada)

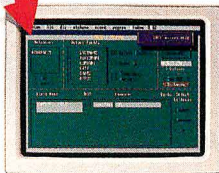
PROXY™

those that support a host running Windows. So they allow just one connection at a time, and demand total attention from your computer. But Proxy is a Windows application that lets you make multiple connections simultaneously. You can display and control a different host PC in each window you open, while you continue to run local applications.

Users Calling For Help? Leap Out The Nearest Window.

If your job is to help users on the network, Proxy will make it easier.

Run time-consuming jobs on dedicated processors, and control them all from Proxy.



**FUNK
SOFTWARE**

System Requirements: Proxy "Master" runs in Windows and can control multiple "Hosts" running DOS or Windows over an IPX network (e.g. NetWare).

© 1992 Funk Software, Inc. Proxy is a trademark of Funk Software, Inc.

Funk Software, 222 Third Street, Cambridge, MA 02142 Tel (617) 497-6339 Fax (617) 547-1031

Circle 160 on Inquiry Card (RESELLERS: 161).

the fax server. Each client workstation images the document and deposits an assigned folder for it on the file server. The fax-server software periodically scans all the folders in search of unsent faxes. The client workstation images the fax body but leaves the imaging of the cover page to the server. This ensures that date and time stamps are based on transmission time, not on when the fax request entered the queue.

You can make Faxstf as unobtrusive or

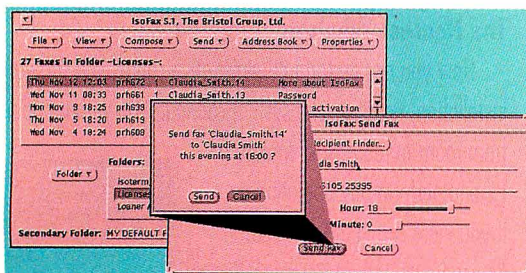
intrusive as you like. The default option is notifying you when a fax either is transmitted successfully or fails, but you can choose to be notified for different conditions.

Fax transmissions can notify you as soon as they are completed, or you can choose to check the activity log periodically to see if the transmission was successful. Client workstations maintain individual activity logs. Even though you

can print these logs and export them to a variety of word processing formats, they can't be exported to any format importable by a spreadsheet or database. This makes integration with an automated accounting and analysis application difficult.

Faxstf receives incoming faxes; however, it does away with any routing problems by making all incoming faxes available to all users. This can cause serious problems for large organizations.

Fax Servers for Unix



IsoFax provides an Open Look client interface that lets you configure all the usual sending parameters, including delayed transmission. It also runs in terminal and command-line environments.

IsoFax 5.1

The Bristol Group's Isofax goes beyond most fax packages in its document management support. Besides the basic fax transmission and reception, IsoFax provides OCR on incoming documents and a searchable document management front end that lets you locate faxes based on user-entered keys, such as subject, date, recipient, and keywords. You can't search the cover-page quick message area, although this would make a good addition. You can search phone books by keywords.

IsoFax can run in three environments: command-line (scriptable), VT100 terminal (text-only screen), and Sun Open Look. This flexibility ensures that even remote users have the ability to compose and transmit fax messages.

All Bristol's documentation is geared toward Sun workstations, resulting in a trouble-free, step-by-step installation. We had the system operational within half an hour of inserting the tape cartridge. Licensing is based on a floating-network license, simplifying administration. A 50-user system costs \$3490.

You can compose faxes from a separate Faxtool application or fax directly from any X Window System application. Direct faxing requires that you select the xfax queue as your printer. When you print, a window appears that lets you select recipients and a cover letter.

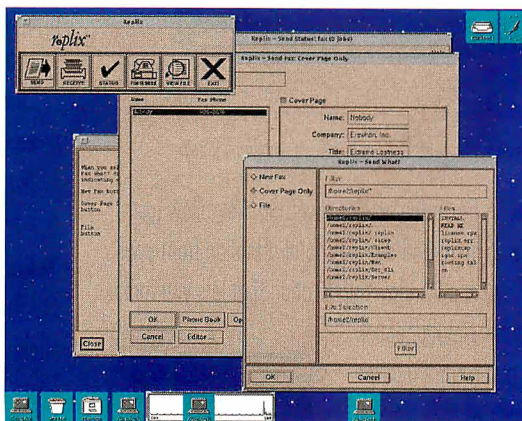
Faxtool's fax composition method is the same in each environment. You select

a sequence of files, consisting of cover page, text, PostScript, and Sun raster data, to be gathered into a single fax. You then select the fax's destination—either single or multiple recipients—and create a fax

image that is transmitted to the server. ASCII files may be imaged either at screen-raster quality or by converting to PostScript fonts. Although slower, PostScript produces a somewhat higher-quality output. To save time with frequently faxed information, you can also include preimaged files.

Cover sheets may be either ASCII or PostScript source files. In either case, you define data fields, such as To, From, and Subject, through ASCII escape sequences. IsoFax does not provide any sort of interactive cover-page design utility.

Since you're assigned a separate fax directory, the operating system provides the security. Additional security is available by entering a key to scramble transmitted and received fax images.



The icon bar is the pivot point that Replix revolves around. Administrators and users share a common set of tools in the toolbar, but administrators have access to an additional administration icon.

Replix 1.0

Replix is Samsung's first foray into the world of Unix business software—and it's an excellent first effort. The terms *well-crafted* and *easy to use* paint an accurate picture. From the excellent documentation to the simple and obvious interface, this product is designed for ease of use. Yet behind this surface simplicity is a powerful engine we wish wasn't restricted to the Unix platform.

Replix can transmit faxes from a command-line or X Window System interface, or directly from third-party applications that produce ASCII or PostScript output through print capture. The X interface includes a simple text editor for quickly composing short faxes.

The stand-alone Replix application is a well-integrated, multiple-window interface that gives you access to all Replix functions. The fax administrator works within the same interface with an additional administration icon.

You can build faxes from ASCII, PostScript, and various bit-map format files. Once your fax is composed, you can view

CA-REALIZER—Now For A Limited Time Only \$99.

Above And Beyond Basic.

INTRODUCING THE EASIEST BASIC DEVELOPMENT SYSTEM FOR WINDOWS.

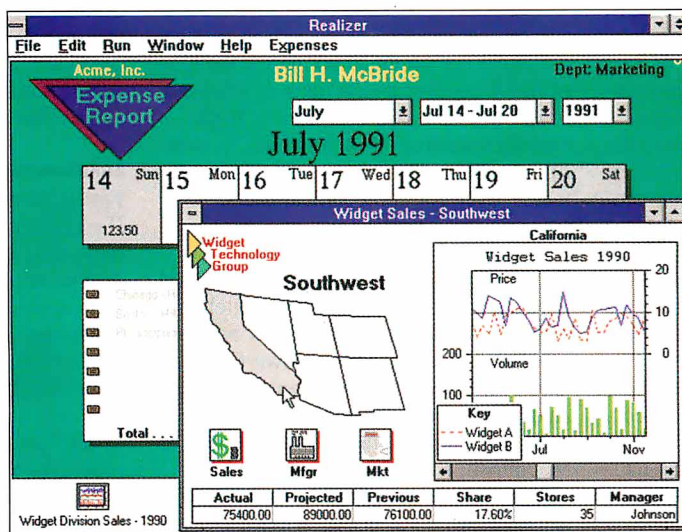
Compared to Visual BASIC, CA-REALIZER® is half the cost and twice the product.

Develop applications using the familiar procedural language model and a large array of powerful tools. You don't need to learn all kinds of confusing new techniques. Just type in programs or design them visually with FormDev. It's an interactive

WYSIWYG, point and click tool that generates code. With a single command you can add Programmable Application Tools like spreadsheets, charts, text editors, animation, graphics tablets and user-friendly forms. And CA-REALIZER offers many features other BASICs don't, like automatic array processing.

Arrays are re-dimensioned and processed automatically. Algorithms can be written as formulae instead of complex looped expressions.

Once an application is complete, you can compile it into a stand-alone Windows application and distribute it



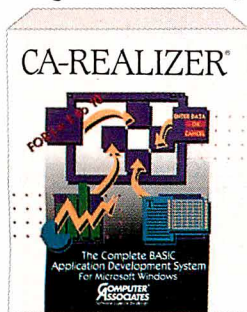
royalty-free with the run-time module that's included. And you can generate an installation disk with the push of a button.

PC Computing said, "No other Windows BASIC can match it for power and breadth of features."



And at \$99, they can't match the price either.

So call 1-800 CALL CAI today for more information and the name of your nearest dealer.



	REALIZER	Visual BASIC
Interactive WYSIWYG Application & Form Designer	✓	✓
Generates User Accessible & Modifiable BASIC Code	✓	
Familiar Procedural Programming Model	✓	
Integrated Full-Featured Debugger	✓	
Single-Stepping, Call-Tree, Variable Display	✓	
Automatically Expandable Dynamic Arrays	✓	
Full Range Of Fast Array Operators & Functions	✓	
Mathematical, Statistical, Date-Time Functions	✓	
Dynamic Addition & Removal Of Form Objects	✓	
Fully-Integrated Programmable Application Tools:	✓	
Charts, Spreadsheets, Text Editors, Graphics, Animation, Scheduler	✓	
Ability To Run Multiple Applications Simultaneously	✓	
Full Support For DDE & DLLs	✓	✓
Direct MDI Support & Serial Communications Library	✓	
Import/Export Of 1-2-3, Excel, CA-SuperCalc Files	✓	
Extensive Context-Sensitive On-Line Help	✓	✓
Clip Art Library With Over 250 Bitmaps	✓	
QuickBASIC Version 7.0 Compatibility Libraries	✓	

Don't waste another day trying to figure out Visual BASIC. Leave that for your competition.

COMPUTER ASSOCIATES
Software superior by design.

CA-Realizer

© Computer Associates International, Inc., One Computer Associates Plaza, Islandia, NY 11788-7000. All product names referenced herein are trademarks of their respective companies. CA-REALIZER Release 1.0 and Visual BASIC Release 1.0 compared 10/92. Cost comparison based on Visual BASIC Release 1.0 Suggested Retail Price. PC Computing quote appeared 10/91, pg. 90.

Circle 74 on Inquiry Card.

it and rearrange pages at will. Cover pages consist of PostScript files that contain ASCII escape sequences indicating key data fields such as To, From, and Subject. Cover sheets can include an optional signature graphic, which you can choose to include at send time.

In Replix, each fax has an owner. Even multiple users with the same name on different clients are differentiated. All outgoing faxes are stored in the same directory. However, individual users can see the status only of the faxes they own. Fax administrators (there can be several) can see and manipulate all faxes. Both users and administrators can run queries against the fax list specifying keys such as date, time, user, or recipient.

Incoming faxes are also stored in a single directory. Once faxes are received, a fax administrator must route the fax to the proper destination. This is done in one of several ways. The administrator can simply change the ownership of the fax, so the addressee will see it when next checking the fax status. Or Replix can send an E-mail message indicating that a fax has arrived. Alternatively, you can send the entire fax via E-mail.

Replix contains a set of hooks that allow integration of custom applications. Events such as a send or retrieve request, phone-line access, or fax reception act as triggers. A simple example of a custom application would be to send E-mail to a

Unfortunately, no single fax server will serve every network environment.

particular fax administrator noting the time of day whenever a new fax was received.

At \$6713 for a 50-user license, Replix is rather expensive. It is, however, powerful, capable, and—most surprising—easy to use, even for nontechnical users.

Fax Populi

Obviously, the fax-server market is filled with capable packages. Unfortunately, no single fax server will serve every network environment, and the most powerful packages don't have the best client interfaces. And as we mentioned earlier, none of these packages supports mixed DOS/Windows, Macintosh, and Unix clients.

We ended up choosing our favorite packages on a variety of criteria—some

for strong client support, and some for scalability and ease of administration. However, each of the packages we chose was at least among the easiest to use on its platform.

For NetWare networks, you can make a very good selection from among Alcom's LanFax Redirector, Intel's Net Satisfaction, Cheyenne's Fax-serve, or Optus's Facsys. For PCs running on non-NetWare LANs, LanFax Redirector is the best choice, although Pure Data's PureFax makes a good economical server.

Of the Mac packages, Circuit Research's 4Sight is the more capable package in large organizations, even though we preferred the interface STF Technologies' Faxstf provides. Finally, despite its newcomer status, Samsung's Replix is the best package we have seen for Unix networks. ■

ACKNOWLEDGMENT

The authors would like to thank Pete Davidson of Davidson Consulting (Burbank, CA) for his contribution to the background research for this article.

Raymond GA Côté and Stan Wszola are testing editors for the BYTE Lab. Steve Apiki is a BYTE Lab technical editor. You can reach them on BIX as "rgacote," "stan," and "apiki," or on the Internet at rgacote@bytepb.byte.com, stan@bytepb.byte.com, and apiki@bytepb.byte.com, respectively.

COMPANY INFORMATION

Alcom Corp.
(LanFax Redirector 2.1)
1616 North Shoreline Blvd.
Mountain View, CA 94043
(415) 694-7000
fax: (415) 694-7070
Circle 987 on Inquiry Card.

The Bristol Group, Ltd.
(IsoFax 5.1)
100 Larkspur Landing Cir.,
Suite 200
Larkspur, CA 94939
(415) 925-9250
fax: (415) 925-9278
Circle 988 on Inquiry Card.

Calculus, Inc.
(Advanced EZ-Fax for
Networks 3.53)
1761 West Hillsboro Blvd.
Deerfield Beach, FL 33442
(305) 481-2334
fax: (305) 481-1866
Circle 989 on Inquiry Card.

Cheyenne Software, Inc.
(Faxserve 1.0)
55 Bryant Ave.
Roslyn, NY 11576
(800) 243-9462
(516) 484-5110
fax: (516) 484-3493
Circle 990 on Inquiry Card.

Circuit Research Corp.
(4Sight Fax 2.0.3)
2 Townsend W, Suite 6
Nashua, NH 03063
(603) 880-4000
fax: (603) 880-8297
Circle 991 on Inquiry Card.

Intel Corp.
(Net Satisfaction Software
2.0, Satisfaction Modem/200)
5200 Northeast Elam Young
Pkwy.
Hillsboro, OR 97124
(800) 538-3373
Circle 992 on Inquiry Card.

OAZ Communications
(NetFax 4.01)
44920 Osgood Rd.
Fremont, CA 94539
(800) 638-3293
(510) 226-0171
Circle 993 on Inquiry Card.

Optus Software, Inc.
(Facsys 3.30a)
100 Davidson Ave.
Somerset, NJ 08873
(908) 271-9568
fax: (908) 271-9572
Circle 994 on Inquiry Card.

Pure Data, Inc.
(PureFax 3.1)
1740 South I-35
Carrollton, TX 75006
(214) 242-2040
fax: (214) 242-9487
Circle 995 on Inquiry Card.

STF Technologies, Inc.
(Faxstf Net 2.2.3)
Jct. I-70 & Hwy. 23
P.O. Box 81
Concordia, MO 64020
(816) 463-2021
fax: (816) 463-7958
Circle 996 on Inquiry Card.

Samsung Software America
(Replix 1.0)
1 Corporate Dr.
Andover, MA 01810
(800) 899-7724
(508) 685-7200
fax: (508) 685-4940
Circle 997 on Inquiry Card.

Get 3 Books for only \$4⁹⁵

plus 1 book FREE upon prepayment
when you join the **Computer Professionals' Book Society**

YES! Rush me the following titles, billing me just \$4.95 (plus shipping/handling & sales tax). Enroll me as a member of the **Computer Professionals' Book Society** according to the terms outlined in this ad. If not satisfied, I may return the books within 10 days for a full refund and my membership will be cancelled. I agree to purchase just 3 more selections at regular Society prices during the next 2 years and may resign anytime thereafter.

Code #'s of my books for \$4.95

--	--	--

If you select a book that counts as 2 choices, write the book number in one box and XX in the next.

☐ Bill me (FREE book not available with this payment option.)

SPECIAL OFFER! Prepay your order by check, money order, or credit card and receive a 4th book of your choice FREE.

☐ **YES!** I want the FREE BOOK indicated below. My introductory payment of \$4.95 plus \$4.95 shipping/handling* and applicable sales tax is enclosed. Code # of my FREE book:

SINGLE
SELECTION ONLY

☐ Check or money order enclosed made payable to: McGraw-Hill, Inc.
☐ Please charge my: ☐ VISA ☐ MasterCard ☐ Amer. Exp.

Acct. No. _____ Exp. Date _____

Signature _____
(required on all credit card orders)

Name _____

Address/Apt.# _____

City _____ State _____

Zip _____ Phone _____

Offer valid for new members only, subject to acceptance by CPBS. U.S. orders are shipped 4th Class Book Post. Canada must remit in U.S. funds drawn on U.S. banks. *Canadian orders are shipped International Book Post—add \$9.25 shipping/handling. Applicants outside the U.S. and Canada will receive special ordering instructions. A shipping/handling charge & sales tax will be added to all orders. ©1993 CPBS RYP293

Get 3 Books for only \$4⁹⁵

plus 1 book FREE upon prepayment
when you join the **Computer Professionals' Book Society**

YES! Rush me the following titles, billing me just \$4.95 (plus shipping/handling & sales tax). Enroll me as a member of the **Computer Professionals' Book Society** according to the terms outlined in this ad. If not satisfied, I may return the books within 10 days for a full refund and my membership will be cancelled. I agree to purchase just 3 more selections at regular Society prices during the next 2 years and may resign anytime thereafter.

Code #'s of my books for \$4.95

--	--	--

If you select a book that counts as 2 choices, write the book number in one box and XX in the next.

☐ Bill me (FREE book not available with this payment option.)

SPECIAL OFFER! Prepay your order by check, money order, or credit card and receive a 4th book of your choice FREE.

☐ **YES!** I want the FREE BOOK indicated below. My introductory payment of \$4.95 plus \$4.95 shipping/handling* and applicable sales tax is enclosed. Code # of my FREE book:

SINGLE
SELECTION ONLY

☐ Check or money order enclosed made payable to: McGraw-Hill, Inc.
☐ Please charge my: ☐ VISA ☐ MasterCard ☐ Amer. Exp.

Acct. No. _____ Exp. Date _____

Signature _____
(required on all credit card orders)

Name _____

Address/Apt.# _____

City _____ State _____

Zip _____ Phone _____

Offer valid for new members only, subject to acceptance by CPBS. U.S. orders are shipped 4th Class Book Post. Canada must remit in U.S. funds drawn on U.S. banks. *Canadian orders are shipped International Book Post—add \$9.25 shipping/handling. Applicants outside the U.S. and Canada will receive special ordering instructions. A shipping/handling charge & sales tax will be



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES



BUSINESS REPLY MAIL

FIRST CLASS MAIL PERMIT NO. 9 BLUE RIDGE SUMMIT, PA

POSTAGE WILL BE PAID BY ADDRESSEE

***Computer Professionals'
Book Society***

A Division of McGraw-Hill, Inc.
Blue Ridge Summit, PA 17214-9974



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES



BUSINESS REPLY MAIL

FIRST CLASS MAIL PERMIT NO. 9 BLUE RIDGE SUMMIT, PA

POSTAGE WILL BE PAID BY ADDRESSEE

***Computer Professionals'
Book Society***

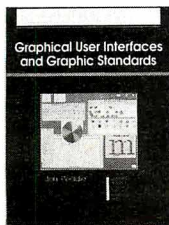
A Division of McGraw-Hill, Inc.
Blue Ridge Summit, PA 17214-9974



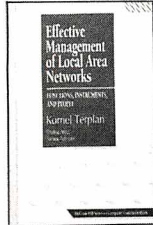
3 books for only \$4⁹⁵

Values to
\$169.80

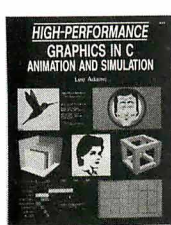
Plus 1 book FREE upon prepayment
when you join the *Computer Professionals' Book Society*



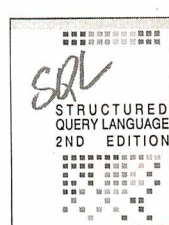
049215-XX \$39.95
Counts as 2



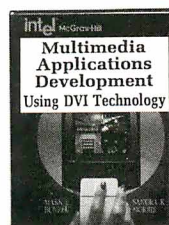
063636 \$39.95



4103 \$34.95



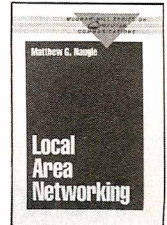
3803P \$21.95
Softcover



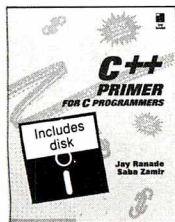
043297-XX \$39.95
Counts as 2



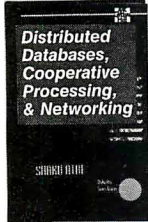
034607 \$39.95



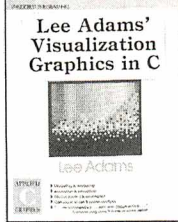
046455 \$34.95



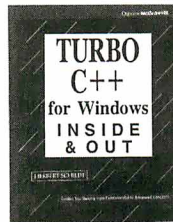
911315-XX \$49.95
Counts as 2



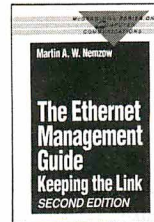
157673 \$49.95



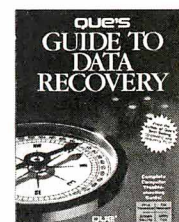
3487-XX \$36.95
Counts as 2



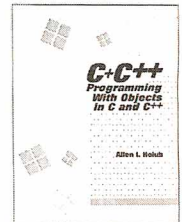
881778 \$27.95
Softcover



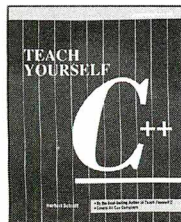
046320-XX \$44.95
Counts as 2



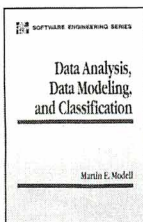
586104 \$29.95



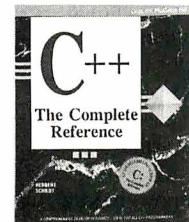
029662 \$24.95
Softcover



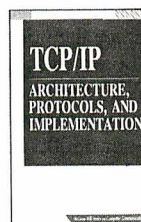
881760 \$24.95
Softcover



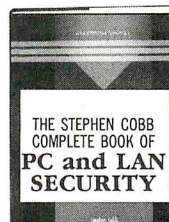
042634 \$39.95



881654 \$29.95
Softcover



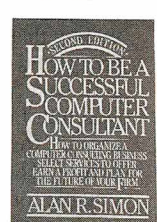
020346-XX \$44.95
Counts as 2



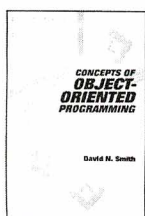
3280 \$36.95



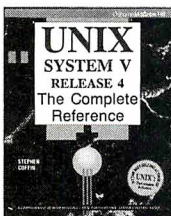
051264-XX \$49.95
Counts as 2



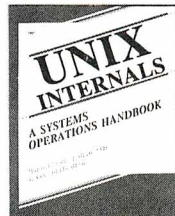
9339 \$32.95



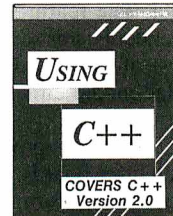
10039P \$24.95
Softcover



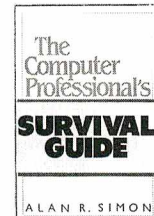
881653-XX \$29.95
Counts as 2/Softcover



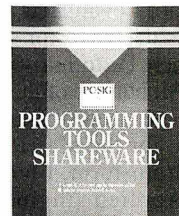
2951P \$19.95
Softcover



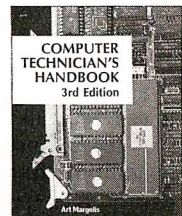
15034P \$24.95
Softcover



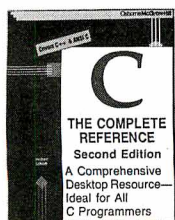
057574 \$24.95



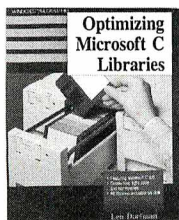
3919P \$29.95
Softcover



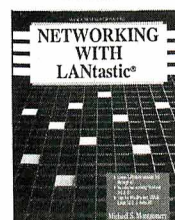
3279-XX \$36.95
Counts as 2



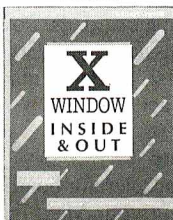
9309-XX \$29.95
Counts as 2/Softcover



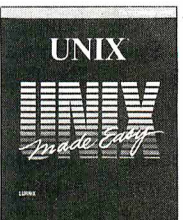
3735 \$34.95



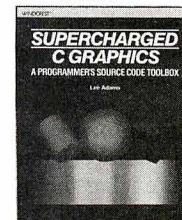
4273-XX \$34.95
Counts as 2



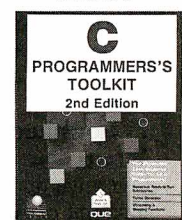
881796 \$27.95
Softcover



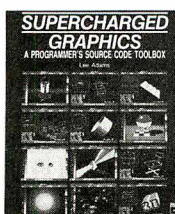
881576-XX \$24.95
Counts as 2



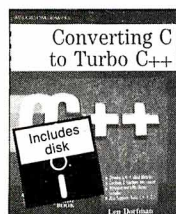
3289P \$24.95
Softcover



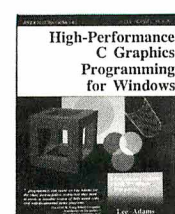
586118-XX \$39.95
Counts as 2



2959P \$21.95
Softcover



4084-XX \$39.95
Counts as 2



3049P \$29.95
Softcover

As a member of the Computer Professionals' Book Society . . .

. . . you'll enjoy receiving Society bulletins every 3-4 weeks containing exciting offers on the latest books in the field at savings of up to 50% off of regular publishers' prices. If you want the Main Selection do nothing and it will be shipped automatically. If you want another book, or no book at all, simply return the reply form to us by the date specified. You'll have at least 10 days to decide and if you ever receive a book you don't want, due to late mail delivery of the News, you can return it at our expense. And you'll be eligible for *FREE BOOKS* through the *NEW Bonus Book Program*. Your only obligation is to purchase 3 more books during the next 2 years, after which you may cancel your membership at any time.

BYP293

If you select a book that counts as 2 choices, write the book number in one box and XX in the next. All books are hardcover unless otherwise noted. Publishers' prices shown. A shipping/handling charge and sales tax will be added to all orders. ©1993 CPBS

If card is missing, write to:

Computer Professionals' Book Society, Blue Ridge Summit, PA 17294-0870

HARDWARE

New Tricks for Slow Macs

RICK GREHAN

If your love affair with the Macintosh has cooled because your 68000- or 68020-based machine doesn't run today's software or does so in a painfully slow manner, a Mac accelerator board may rekindle the flame. There are now dozens of accelerator boards on the market that can upgrade your system with 68030 and 68040 CPUs running at 25, 33, and even 50 MHz. In addition, these accelerator boards can provide math coprocessors for systems that never had them before. The result is a faster Mac that's suitable for today's applications for an upgrade cost of between \$250 and \$1700 (depending on the Mac model you have).

For this roundup, I evaluated 17 Mac accelerator boards designed for systems ranging from the new Performa 400 to the aged Mac 512K. All but one of the boards can be installed by end users (the exception is the Brainstorm, for the Mac Plus). In addition to the Brainstorm, I looked at products from Applied Engineering, DayStar Digital, Dove Computer, Extreme Systems, Fusion Data Systems, Harris Laboratories, Impulse Technology, MacProducts USA, Mobius Technologies, System Technology, and Total Systems.

Performance Indicators

When choosing a Mac accelerator board, you must make sure it has the right combination of performance and features for your applications. The text box "When to Upgrade" on page 202 describes the advantages of the 68030 and 68040 CPUs as well as the 68881 and 68882 floating-point processors. The table shows the benchmark results of each accelerator board running the BYTE Lab's latest version of its Macintosh benchmarks (for more information on the benchmarks, see this month's Reviewer's Notebook). The table also shows pricing, compatibility, and other essential information about the boards.

As you examine the boards' perfor-

mance and features, consider what special requirements you may have. Do you need a number cruncher? If so, an accelerator board with a high FPU index should be your first pick. How about a large-screen monitor? One of the boards that come with a video adapter could be the best choice. Finally, compare the price you'd pay for an accelerator board to the cost of buying a new Mac. With the low prices of today's Macs, you may find it's more economical to trade in your 68000-based system for a newer model.

My Macintosh test-bed represented a good sampling of the available Mac models. I used a Mac Plus, SE, SE/30, LC II, II, IIfx, and IIsi. The features table shows which accelerator boards support each Mac model. Most of the boards run in more than one Mac model either as is or with an adapter card.

Some manufacturers produce an entire line of accelerator boards, each targeted at a different Mac platform. One example is the DayStar PowerCache, which can plug directly into a IIfx or a Performa 600. With an adapter card, the PowerCache will fit into a Classic, SE, SE/30, LC, LC II, II, IIfx, IIfx, IIsi, or Performa 400. Quite a chameleon act.

Installation

Adding an accelerator board always starts with opening your Mac. In general, it is more difficult to upgrade a Plus, Classic, SE, or SE/30; this is due largely to their construction. Successfully popping open one of these Macs is right up there with shucking an oyster: It's not easily done without the right tools.

Unhooking all the cables from the motherboard requires no small amount of contortions as you seek to avoid the stem of the CRT and the exposed components of the power supply (again, this is especially true for Pluses, Classics, and SE-class machines). Dangerous voltages are afoot, even for a period of time after you have un-



plugged the system. So, it's important to remove metal watchbands, bracelets, rings—anything conductive that might inadvertently make you part of a circuit—before you begin. Plan on spending about an hour upgrading a Plus, Classic, or SE machine. And don't forget to bring your torx, a case-cracking tool, and a couple of screwdrivers.

Getting into other Mac models is a cakewalk by comparison. You simply remove one screw on the back of the machine and pop off the top. On average, you can install an accelerator board in these models in



about a half hour. Possible installation snags may arise. For example, if you install the Voyager 030 in a Mac II, you must detach the drive platform and pry the CPU and PMMU (paged memory management unit) chips from their sockets.

However, don't let these apparent dangers keep you from considering the possibility of getting an upgrade. Many manufacturers offer free installation.

Board Configurations

Most of the accelerator boards I tested were 68030-based; a smaller number were

68040-based, while the Performer2 and the ever-unique Brainstorm used a 68000. All the 68030 boards were socketed to accept a 68881 or 68882 FPU, and all the units I tested had 68882 coprocessors installed. All the 68040 cards have no need for an FPU socket, because they use a version of the CPU with an integrated FPU. (The 68000-based Performer2 comes with a 68881 coprocessor.)

The Mobius accelerator boards for the SE and Classic, as well as the Vandal SE, RailgunPro 030, and (optionally) the Gemini Ultra for the SE, also include graphics

BYTE ACTION SUMMARY

■ WHAT MAC ACCELERATORS ARE

Add-on boards that boost the performance of your Macintosh. Most accelerator boards provide an optional FPU; some increase memory.

■ LIKES

Performance improvements for virtually all applications.

■ DISLIKES

For owners of Pluses, Classics, and SE-class machines, installation can be an ordeal. Even some Mac II installations require chip-pulling.

■ RECOMMENDATIONS

The Gemini Ultra is a top choice for speeding up a bare-bones SE. For out-and-out speed, choose the Performance/040.

adapters as part of the accelerator hardware. This lets you connect displays that are larger than 9 inches to Mac SEs and Classics.

Some accelerator boards, especially those for the Classic and SE, carry SIMM sockets for holding memory local to the board. This on-board memory keeps up with the faster processor without a lot of wait states. For example, the Gemini Ultra can take your SE from its ordinary maximum of 4 MB to a previously unheard-of 64 MB (ideal for memory-hungry graphics applications or a big RAM disk).

The Software Side

The installation software that comes with the boards usually uses a control panel design. For the 68030 boards, this control panel program consists of a simple dialog box with on/off switches that let you enable or disable the CPU's instruction and data caches. As I'll discuss later, this plays an important role in compatibility.

The 68040 boards' control panel software typically allows you to select cache modes: copyback, write-through, or none. With the TokaMac boards, the control panel lets you choose only copyback or write-through modes. A cache running in copyback mode is fastest: Data written to the cache is written to main memory only when it's absolutely necessary. Hence, the processor is less frequently burdened

MAC ACCELERATOR BOARD FEATURES AND BENCHMARKS

The benchmark results shown below are normalized to the performance of a 4-MB Mac SE/30; see text for further details. For installation difficulty, easy = you simply open the top of the machine and plug in the accelerator board; moderate = some cabling is necessary; hard = you must pull chips, perhaps do some soldering, and attach additional cables. (N/A = not applicable.)

	Brainstorm	Gemini Ultra	Impact	MaraThon Racer	Mobius	Performance/040
Systems available	Plus	Plus, SE, 512K	LC, LC II	Classic, SE	SE, Classic	II, IIx, IIcx, IIci, IIfx, IIsi
Systems tested	Plus	SE	LC II	Classic, SE	Classic, SE	IIsi
Price	\$249	\$1018	\$698	\$599	\$594 (SE); \$644 (Classic)	\$1750 (25 MHz); \$2399 (33 MHz)
Processor	68000	68030	68030	68030	68030	68040
Processor speeds (MHz)	16	20, 33, 50	32	16	25	25, 33
External CPU cache	None	None	32K	32K	None	None
Coprocessor	None	882	882	882	882	N/A
Maximum RAM	N/A	64 MB	None	None	16 MB	128 MB
Software	None	A, B, C	C	C	A, B, C	E
Video adapter available?	No	Optional	No	No	Yes	No
Warranty	1 year limited	1 year	1 year limited	90-day replacement	2 years parts/labor	1 year limited
Installation difficulty	Hard	Moderate	Easy	Moderate	SE: moderate; Classic: hard	Easy
BENCHMARKS						
CPU speed tested (MHz)	16	50	32	16	25	33
CPU index	0.5	2.1	1.3	Classic: 0.8; SE: 0.7	Classic: 1.3 ¹ ; SE: 1.3	2.6 ¹
FPU index	0.3	10.3	5.7	Classic: 1.8; SE: 1.8	Classic: 4.3; SE: 3.8	14.5

Notes:

- ¹ One or more benchmark applications could run only if some of the board's features were disabled (see text).
² Mathcad failed to see the board's FPU.

Software key:

- A = RAM disk
 B = Copy ROM to RAM
 C = Faster SANE
 D = Patch for 68040
 E = Application/cache tracking

with the additional CPU cycles of writing to external memory. Write-through mode, as its name implies, sends data to the cache as well as to main memory, so the processor suffers a slowdown with every write operation. (Note that copyback and write-through modes do not apply to the instruction cache; this is a read-only cache.)

Some accelerator boards carry their own RAM on-board for the CPU to directly access. However, this causes the RAM that's already on the motherboard to go largely unused. Consequently, many accelerator boards come with software that creates a "crash-resistant" RAM disk in the motherboard RAM. Here, *crash-resistant* doesn't mean that the RAM disk is invulnerable; if you turn your machine off, the information is indeed lost. Instead, the RAM disk is crash-resistant in the sense that if a program dies and takes your Mac with it, you can reboot using the programmer switch and the RAM disk will be intact. Depending on the amount of memory you're able to allocate to the

RAM disk, it could be an ideal place to put things like temporary files that your application creates, the HyperCard Home stack, and so on.

To maximize performance, some accelerator boards copy ROM to the accelerator's RAM at start-up. You get a boost from this option because ROM has a longer access time than RAM. Moving the code to RAM means that the frequently executed Toolbox routines in ROM can be run from the faster RAM.

FPU Considerations

Many of the accelerator boards that come with FPUs offer software that patches the Mac's SANE (Standard Apple Numeric Environment) calls to provide faster floating-point operations. Some go beyond simply redirecting floating-point calls from SANE routines to the FPU itself. For example, the Transwarp CI board comes with software that implements what Applied Engineering calls '882 Express. When '882 Express is active, it bypasses routines in Apple's SANE package that check

the results of the FPU for accuracy. When this accuracy checking is unnecessary (it apparently takes place only for some of the trigonometric functions), '882 Express should result in improved performance.

As good as caching and ROM-copying sound, they don't always work. Some software simply won't work with caching enabled. This is not a fault of the accelerator board; it's what happens when the board tries to run software written by programmers who weren't thinking ahead to these days of cached, high-speed 68xxx CPUs. For example, I was unable to run PageMaker 4.0 on the TokaMac boards with the cache in copyback mode.

Most compatibility problems are linked to the CPU cache and occur frequently in programs that execute self-modifying code. (See this month's Reviewer's Notebook for more details.) Many accelerator board manufacturers provide a list of incompatible applications and, in some cases, tell you how to solve the problem.

Other manufacturers take a more active approach to solving incompatibilities.

NEW TRICKS FOR SLOW MACS

Performer2	PowerCache	Quik30	RailgunPro 030	TokaMac	Transwarp CI	Vandal SE	Voyager 030
Classic, SE	SE/30, LC, LC II, II, IIx, IIcx, IIsi, IIci, Performa 400 and 600	SE	Plus, SE, Classic	IIci, LC, SE/30, IIsi	IIci	SE	II, IIx
SE	IIci	SE	SE	SE/30, IIci	IIci	SE	II
\$249	\$1599	\$795	\$899 (SE)	\$1695	\$1265	\$699	\$1509
68000	68030	68030	68030	68040	68030	68030	68030
16	33, 40, 50	16, 25, 33	16, 25, 33	25	50	33, 50	33, 50
96K	32K	None	None	None	64K	None	64K
881	882	881, 882	881, 882	N/A	882	882	882
None	None	16 MB	16 MB	None	None	16 MB	8 MB
None	C	A, B	A, B	D	C	B, C	A, B, C
Soon (\$149 extra)	No	No	Optional	No	No	Yes	Optional
Lifetime	3 years limited	2 years parts/labor	1 year parts/labor	1 year (hardware)	1 year	1 year (hardware)	1 year
Moderate	SE/30: moderate; II, IIx, IIcx: hard; others: easy	Moderate	Moderate	Moderate (SE) to easy	Easy	Moderate	Hard
16	50	33	33	25	50	33	50
0.5	2.3	1.7	1.5	SE/30: 1.87 ¹ ; IIci: 2.2	2.2	1.6	1.9
0.7 ²	7.5	5.3	4.6	SE/30: 3.85; IIci: 5.43	7.7	7.6	8.2

For example, the 68040-based TokaMac boards come with a program called Multipatch that searches an executable file for code that uses 68020/68030 cache-clearing instructions and replaces them with their 68040 equivalents. The Performance/040's control panel lets you build a *compatibility list*. This is a list of software package names and an associated compatibility rating, which indicates which cache mode the software can run (copyback, write-through, or none). When you launch a program, the Performance/040's software checks the compatibility list and automatically sets the cache mode appropriately.

Often, however, you have to resort to experimentation. If your application blows up, you must turn off features one at a time until the program starts working again. Then when you've identified the feature that creates the problem, you reenable the other features one by one, verifying each time that the program still executes. This is a lot of work, but it's worth it for applications that you use frequently.

It's also possible that you'll have to up-

date your applications to run in accelerated mode. For example, to run Microsoft Word 4.0d on the Performance/040, you have to disable the cache. However, Word 5.0 will run on the Performance/040 with the cache enabled and in copyback mode.

If all else fails, you can always run your system in its unaccelerated mode. All the boards I tested (except for the Brainstorm) let you boot your system so that it appears to be operating with its original hardware. In most cases, you reboot the machine by pressing the reset and interrupt switches in a particular sequence. Since the Brainstorm actually alters components on your Mac Plus's motherboard, a Brainstormed Mac Plus is forever accelerated.

Lab Tests

The BYTE Lab's application and low-level benchmarks exercise all components of the system—graphics, CPU, FPU, and disk. I focused on those tests that would most likely indicate a system's CPU and FPU power. Since I was testing the boards on a variety of systems with differing disk

and graphics systems, it would be unreasonable to compare, for example, the database scores of one accelerator board to those of another.

I ran all tests under System 7.0.1. For systems that support a color monitor, I reduced the display depth to monochrome. For those accelerator boards that support on-board RAM, I ran them with 4 MB on the accelerator board (usually, this meant that I needed to have 4 MB on the system board). Otherwise, I ran them with 4 MB on the motherboard. (The exception was the Voyager 030, which ran with 8 MB in a Mac II.)

To derive a CPU index, I took the results from the BYTE Microsoft Word tests, PageMaker tests, Think C tests, and low-level CPU benchmarks. The index is simply the nonweighted average of the times normalized against the results taken for an unaccelerated SE 30. The FPU index is composed of results from the BYTE Mathcad tests, Excel tests, and low-level FPU benchmarks. I got the number using the same technique I used for the CPU index.

continued

THIS IS
YOUR
DRIVE



THIS IS
YOUR
DRIVE ON

winSTORE™



ANY
QUESTIONS?



It doubles your performance.
It doubles your disk capacity.
It's fast and easy to install.
It's priced right.

It's winSTORE™, created for the Windows™ user. The first product of its kind, winSTORE combines two award-winning technologies: high-speed disk control from Perceptive Solutions and advanced Stacker™ data compression from Stac,® in a plug-and-play solution.

It's winSTORE—think of it as overdrive for Windows!



Perceptive Solutions, Inc.
800-486-FAST

Main: 214-954-1774 · FAX: 214-953-1774

©1992 by Perceptive Solutions, Inc. winSTORE and the Perceptive Solutions logo are trademarks of Perceptive Solutions, Inc. Windows is a trademark of Microsoft™ Corp. Stacker is a trademark and Stac is a registered trademark of Stac Electronics, Inc.

Circle 117 on Inquiry Card
(RESELLERS: 118).

NEW TRICKS FOR SLOW MACS

When to Upgrade

Does having a faster CPU or FPU justify the time and expense of upgrading? Here's a sketch of the benefits offered by the latest members of the 68000 family.

68030 Essentially an integration of the 68020 CPU and the 68851 PMMU (paged memory management unit). The 68030 includes a 256-byte data cache as well as a 256-byte instruction cache. The 68030's predecessor, the 68020, included only an instruction cache.

The primary advantage of the 68030 is that it's faster than its predecessor due to caches and burst-read mode (used to rapidly fill the caches from main memory). The 68030's integral MMU also lets you use virtual memory under System 7.0 or run A/UX (a 68020 CPU with a 68851 PMMU also accomplishes this, but the communications between the two chips adds overhead).

68040 Integrates a 68030 with a 68881-/68882-compatible FPU. In addition, the instruction cache is extended to 4 KB, and an independent 4-KB data cache is added. Internally, there are multiple independent execution pipelines, so the integer unit (the

CPU), FPU, and MMU can be executing simultaneously.

As with the MMU on the 68030, moving the FPU on-chip in the 68040 improves floating-point performance. The heavy-duty parallel processing inside the CPU enables it to process instructions much faster than the 68030. Finally, the large caches operated in copyback mode mean even faster execution because off-chip bus traffic is minimized.

68881/68882 FPUs. Each coprocessor has eight internal floating-point registers. Both conform to the ANSI/IEEE 754-1985 standard. The 68882 provides increased throughput via simultaneous execution of some floating-point instructions and special-purpose hardware for converting to and from the FPU's internal format.

While the SANE (Standard Apple Numeric Environment) software can handle floating-point processing without special hardware, it does so by executing hundreds of instructions, which take time to execute. Dedicated FPU chips accomplish the same processing in silicon and at a much faster rate. If you require lots of number crunching, budget for an FPU (or the 68040 CPU with a built-in FPU).

As mentioned earlier, some accelerator boards ran into compatibility problems running the applications (although none had any problems running the BYTE low-level benchmarks). The result was typically a bomb box reporting a bus error or an illegal instruction error. When that happened, I would repeatedly try to rerun the application, each time disabling one of the accelerator board's features until the application ran. Then I reenabled those features that did not cause the application to crash.

Sometimes the application refused to execute unless I completely disabled the accelerator board. In such cases, rather than run the test in nonaccelerated mode, I simply left that component out of my calculations of the index. (I did, however, note those cases where compatibility problems arose.) Indexes are listed in the table.

Top Accelerator Boards

I found it difficult to make generalizations about the value of individual boards because performance is so application-specific. It seems more appropriate to make a variety of recommendations. For my money, the Gemini Ultra is a top choice for speeding up a bare-bones SE. Not only does it let you take the SE up to a whopping 64 MB, but you can also tack on the optional video adapter and add a large-screen monitor. The board's no slouch, either, turning in the highest CPU index for SE upgrades and the second-highest FPU index of all the accelerator boards I tested.

For pure speed, the Performance/040 scored highest. I shouldn't let pass, however, the fact that the Performance/040 had some difficulties running some of the BYTE benchmark applications—Word 4.0 and Adobe PageMaker 4.0, for example.

continued

What You Want,

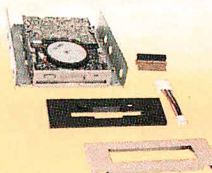


**JAMECO
ServiceLine™**
Computer/Printer
Repair and Support
1-800-831-8020



Keyboards

Fujitsu 101-key enhanced keyboard
Part no.: 2B17128
Product no.: FKB4700
\$79.95



Floppy Disk Drives

Toshiba 1.44MB
3.5" Internal Floppy Disk Drive
Part no.: 2B40774
Product no.: 356KU
\$99.95

Computer Cards

16-bit VGA Card
Part no.: 2B67459
Product no.: VG7700
\$99.95



Cables, Gender Changers, and Adapters

6-foot parallel DB25-pin male to Centronics male printer cable
Part no.: 2B28716
Product no.: PPC6
\$7.95

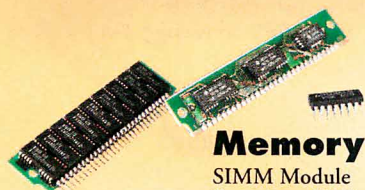
DE9 female to DB25 male serial adapter
Part no.: 2B10305
Product no.: AD925
\$4.95



Memory

SIMM Module
Function: 1MBx9 80ns
Part no.: 2B41769
Product no.: 421000A9B-80
\$47.95

DRAM
Function: 1MBx1 80ns
Part no.: 2B42251
Product no.: 511000P-80
\$4.99



Hard Drives (IDE)

Capacity: 120MB
Speed: 19ms
Part no.: 2B14074
Product no.: CP30104
\$389.95



Metex Digital Multimeters

4.5 digit w/frequency & capacitance & data hold switch
Part no.: 2B27158
Product no.: M4650
\$99.95



Power Supplies

150 watt 8088
Part no.: 2B19465
Product no.: JE1030
\$69.95



**Over 5000
Products in
Stock**

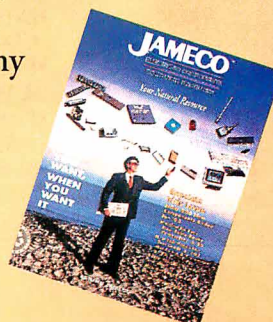
When You Want It.

Jameco offers a full line of competitively priced computer products for immediate delivery. Select what you want from our 100-page catalog. Priority orders placed before 2:00PM(PST) are shipped the same day. All products are backed by our customer service experts and a 30-day full-refund guarantee. Once you buy, you'll understand why millions of customers have been choosing Jameco for over 20 years.

**GET A FREE JAMECO CATALOG
CALL 1-800-637-8471**

Mention
V.I.P.#2B3

© 2/93 Jameco Electronic Components Computer Products.
All trademarks are registered trademarks of their respective companies.
Terms: Prices are subject to change without notice. Items subject to availability
and prior sale. Complete list of terms/warranties is available upon request.



JAMECO™
ELECTRONIC COMPONENTS
COMPUTER PRODUCTS

1355 Shoreway Road, Belmont, CA 94002

Sales: 1-800-831-4242

Jameco ServiceLine™: 1-800-831-8020

Technical Support: 1-800-831-0084

Circle 92 on Inquiry Card.

NEW TRICKS FOR SLOW MACS

As I mentioned earlier, the 68040 doesn't always get along with some applications, so for mission-critical ones, contact Impulse Technology for a compatibility list.

Finally, for sheer ingenuity, I liked the

Mobius board as an upgrade for the Classic. The wraparound design of the board and sneaking the external monitor connector through the Classic's grill indicates an engineering department with a tenacity

that deserves some kind of recognition. ■

Rick Grehan is technical director of the BYTE Lab. You can contact him on BIX as "rick_g."

COMPANY INFORMATION

Applied Engineering

(Transwarp CI)
(214) 241-6060
fax: (214) 484-1365

Circle 1060 on Inquiry Card.

Brainstorm Products

(Brainstorm)
(415) 964-2131
fax: (415) 964-2135

Circle 1061 on Inquiry Card.

DayStar Digital, Inc.

(PowerCache)
(404) 967-2077
fax: (404) 967-3018

Circle 1062 on Inquiry Card.

Dove Computer Corp.

(MaraThon Racer)
(919) 343-5600
fax: (919) 251-9441

Circle 1063 on Inquiry Card.

Extreme Systems

(Impact, Vandal SE)
(206) 575-2334
fax: (206) 575-3928

Circle 1064 on Inquiry Card.

Fusion Data Systems

(TokaMac)
(512) 338-5326
fax: (512) 338-1276

Circle 1065 on Inquiry Card.

Harris Laboratories, Inc.

(Performer2)
(612) 941-2948
fax: (612) 941-3515

Circle 1066 on Inquiry Card.

Impulse Technology, Inc.

(Performance/040)
(404) 889-8294
fax: (404) 781-8738

Circle 1067 on Inquiry Card.

MacProducts USA, Inc.

(RailgunPro 030)
(512) 472-8881
fax: (512) 499-0888

Circle 1068 on Inquiry Card.

Mobius Technologies

(Mobius)
(510) 654-0556
fax: (510) 654-2834

Circle 1069 on Inquiry Card.

System Technology Corp.

(a division of
Novy Systems, Inc.)
(Quik30)
(904) 428-0411
fax: (904) 428-0765

Circle 1070 on Inquiry Card.

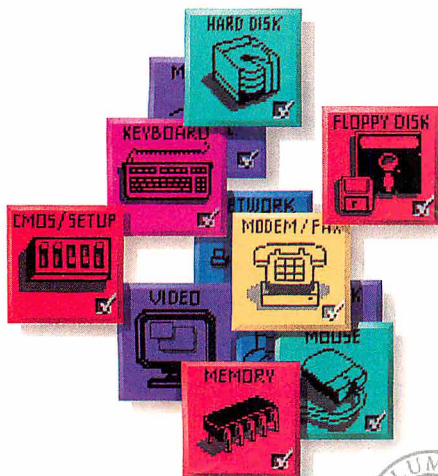
Total Systems

(Gemini Ultra, Voyager 030)
(503) 345-7395
fax: (503) 343-6293

Circle 1071 on Inquiry Card.

INTRODUCING

The First Diagnostic that's All PRO and No CON.



CHECK IT PRO
ADVANCED DIAGNOSTIC SOFTWARE

Check✓It PRO: SysInfo provides the most accurate and comprehensive configuration data ever available. Whether you're planning an upgrade, trying to find a set-up problem, or simply becoming familiar with a new system, Check✓It PRO: SysInfo has the information you need.

- Processor/Co-Processor Model, Manufacturer, and Speed (MHz)
- Detailed Memory Maps: Base/UMB, EMS, XMS, TSRs, Device Drivers and Interrupt Vectors
- REAL Hard Drive Geometry, Model, and Interface Type: MFM, RLL, IDE, SCSI, & ESDI
- Detects Network, Modem, FAX, CD-ROM, and Sound Card Details
- Edit/Save/Restore CMOS, plus DOS & Windows System Files
- Performance Benchmarks compared to Standard or Custom System Profiles
- Built-In Technical Reference Library

The PROs and CONs of SysInfo Utilities

There's a real difference in the information displayed by Check✓It PRO, and other utility programs. For example, Check✓It PRO determines the "live" status of each IRQ – but other programs just show you "standard" assignments. Check✓It PRO also tests your hard drive to find out what type of drive is really attached, not just how CMOS is set up. If it was easy, every program would provide this type of information; but the only one that does is Check✓It PRO. No matter what other program you have, you need Check✓It PRO too.

Try it for yourself. We think you'll agree that the new Check✓It definitely qualifies as a real PRO.



TouchStone
Software Corporation
2130 Main Street, Suite 250
Huntington Beach, CA 92648
Fax (714) 960-1886

(800) 531-0450 or (714) 969-7746

Copyright ©1992 TouchStone Software. ALL RIGHTS RESERVED. Checkit PRO is a trademark of TouchStone Software Corp. Huntington Beach, CA

APPLICATION

The Second Premiere

TOM YAGER

There is every reason to expect that Premiere 2.0, Adobe's QuickTime movie-editing system, will cause as much commotion as the original package did when it started shipping a year ago. Back then, Premiere was the first such application, but it was only one of many pieces Macintosh users required to create a complete QuickTime movie (see "Two Tools of the QuickTime Trade," June 1992 BYTE, and "Cut to Video: Four Programs for Moving Presentations," November 1992 BYTE).

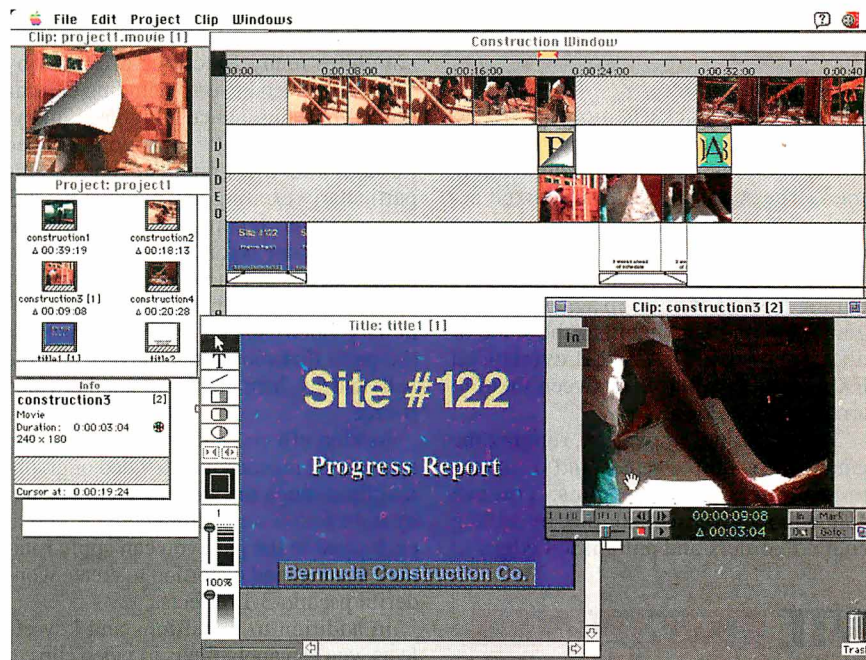
The new Premiere brings more of those pieces together in one package. Version 2.0 has its own video-capture module and titler. It also offers remote control of video decks, and it can export EDL (edit decision list) files for use in full-size editing suites. These additions help make digital video affordable for those who now use analog video or who long for the versatility of broadcast equipment but can't justify the cost.

Building the Set

Premiere 2.0 runs on a Mac IIci or better with 8 MB to 20 MB of memory and a 24-bit graphics card. Premiere will run under System 6.0.7, but System 7.x is preferred. I tested Premiere on both a Mac IIci with an Apple 8•24 GC graphics card and a Quadra 700 with a SuperMac Spectrum 8•24/PDQ graphics card. I ran the IIci with a total of 8 MB of memory. The more powerful Quadra carried a total of 20 MB. I used the SuperMac VideoSpigot, a leading QuickTime capture board, in both test systems.

The Quadra supports digitized audio; I had to equip my IIci with Macromedia's MacRecorder Sound System Pro, an external sound digitizer that plugs into the serial or printer port. The Quadra's audio input is microphone-level; I had to use an attenuating patch cord to make the line-level output of my Panasonic AG-7650 Super-VHS VCR usable.

As it stands, the best that either the internal or external Macintosh audio-digitizing solutions can offer is 22 kHz at 8 bits. Support for 44-kHz audio is supposedly on its way from Apple, and a future upgrade to QuickTime and Sound Manager will bring high-quality audio to Premiere.



Premiere's interface is dominated by the construction window. Video and audio clips are mixed according to their relation to each other on the time line, the placement of transitional effects in the FX track, and attributes such as motion and keying.

Makeup

Premiere's main interface hasn't changed much since the original release. The landscape (see the screen) is dominated by a construction window, in which you assemble tracks of video and audio. Adobe added a preview window in version 2.0, so you can now see a single assembled frame from any point in your sequence. Also new is the movie-capture window. It shows the capture board's input in real time (for focusing, tape positioning, and other adjustments) and provides the interface through which you set various recording preferences.

For the movie-capture feature to work, Premiere requires a VDIG (video digitizer) that matches the capture board you're using. This provides a device-independent layer that Premiere and other QuickTime applications can use to build in capture capability with minimal hassle. Premiere doesn't ship with VDIGs; they all come from capture-board vendors. At press time, VideoSpigot's VDIG was still in beta testing, but fully functional.

Premiere's capture interface calls out to the VDIG not only to capture video but

also to adjust the capture board's settings, select the frame rate and compression method, and otherwise tune the capture system. Video can also be brought into Premiere in real time or one frame at a time. If you connect your Mac to a VCR through VISCA, Diaquest, V-LAN, or another supported video transport control interface, Premiere automatically steps through a video and captures it frame-by-frame. You can then use Premiere to digitally edit that video and record it back to a single-frame-capable VCR one frame at a time. It's a time-consuming operation, but the resulting video is of much higher quality than with real-time capture and playback, and it becomes the rough equivalent of an editing suite for those long on patience but short on cash.

The Cutting Room

To edit video, you drag a clip into one of the construction window's tracks. There are three tracks of video (titles and graphics count as video) and three tracks of audio. You can mix the audio tracks any way you like. You can alter the playback volume of each audio track over time by

moving points on a graph for cross-fades and other dynamic effects. If a video clip has attached audio, they are locked in sync and placed together in the construction window. Stand-alone audio clips containing music, narration, or sound effects can be dragged in and aligned with any location in your video.

Transition Choices

Mixing video tracks is more involved. There are two main video tracks (A and B), and one "super," or superimposition, track. The A and B tracks are mixed according to their overlap, and icons are dragged into the FX (transitional effects) track. A cut edit is arranged simply by butting the end of one clip against the beginning of another (in either the same or different tracks). If A and B overlap, an FX icon can be placed between them to arrange a transition.

The transitions are varied, running the gamut from simple wipes and dissolves to page turns and cube spins. You can gain a more professional look by adding colored borders and antialiased edges to

transitions that use moving shapes. When appropriate, transitions can be adjusted to create unique effects. A zoom transition can be stopped in the middle, for example, for a picture-in-picture effect.

The primary duty of the super track is handling titles and overlaid graphics. Premiere has a versatile software keyer that simulates many functions provided by broadcast video keyers, including chroma (color) and luminance (brightness) keying and image mattes (video is played through a text or graphical shape). One particularly exciting key mode is the difference keyer: It compares each frame of video to the one before it and makes everything that doesn't move transparent. So if you shoot a basketball game with a stationary video camera, you can extract just the parts that move (the players and the ball) and lay them in front of another video source.

Motion effects, a new feature, let you animate the movement of a video or graphics clip through the viewing area. The animation follows a path you create, and at each point in the path you can apply rotation, scaling, and distortion to create wonderful pseudo-3-D effects.

In addition to transitions and key effects, you can apply filters to video clips to change their appearance. There are 41 filters in all, and most of them are special-effects oriented. You can create an undulating dream-sequence effect, make your video ripple like waves in a pond, or spin your video into its center like water down a drain. More practical filters handle tinting and colorization, gamma and color correction, and color filtering.

Weak Links

Unfortunately, filters are one area where Premiere 2.0 falls short. Its filters change the clip's contents directly, and they can only be applied to an *entire* clip. I found that limiting: I wanted the freedom to drag out a section of a clip and apply a filter to it (a competing package, Diva Video-Shop, allows this). You can easily split a clip into two clips and apply a filter to one of them, but that's an awkward work-around.

Another Premiere flaw is an ironic one: It has so much power that some of it is hard to find. You can, for example, make a video clip fly in from a corner, spinning and tumbling as it comes. I would expect to do that as part of a transition, but that's not how it works. Instead, you have to apply a motion effect to a clip and then superimpose it to create a transition from scratch. That's typical of Adobe tools: Between Illustrator and Photoshop, you can accomplish almost anything you want,

but you can also make a career of learning how.

The final weak link in Premiere is its integrated titler. Premiere creates very nice-looking antialiased text (antialiased in the alpha channel, no less), but it comes up disappointingly short in other areas. All colors must be solid—no patterns, image maps, or gradations are allowed. But you can specify a transparency level. Text cannot be rotated or scaled (even though Premiere includes Adobe Type Manager), and the only available effect is shadowing. The integrated titler is better than nothing, but it seems Adobe would prefer you use Illustrator to create more interesting titles. It doesn't fit with the rest of Premiere's professional features.

Once you have lined up everything—video, audio, and effects—you can use the preview window to look at any section of your project. You can view either a reduced-rate moving preview or a snapshot of a particular frame. The snapshot is extremely helpful because you can instantly see whether the transition or superimposition effect you've chosen works as you expected.

When you are satisfied with what you see in preview mode, you can generate a finished QuickTime movie of your job. At this point, you can see your work at the frame rate and resolution you choose, and you can apply your choice of video compression techniques. If you're dissatisfied with any of the results, you can feed the movie back into Premiere for additional editing.

Digital Partner

Premiere 2.0 is a welcome partner for those who use digital video but who aren't ready for more expensive, more capable digital nonlinear editing systems. The program's ability to control external video equipment and output EDLs not only helps Premiere fit into existing video studios but gives all its users room to grow.

The application doesn't do everything, or do everything right, but it remains the standard against which other QuickTime editors are judged. The quality of the material Premiere pumps out (provided you create your titles elsewhere) is as good as QuickTime can manage. Premiere may take some learning to use well, but it's time well invested. ■

Tom Yager is director of BYTE's Multimedia Lab, a multimedia consultant, and the author of The Multimedia Production Handbook for the PC, Macintosh and Amiga (Academic Press, forthcoming). He can be reached on BIX as "tyager" and on the Internet at tyager@bytepb.byte.com.

BYTE ACTION SUMMARY

■ WHAT ADOBE PREMIERE 2.0 IS

Software for capturing and editing QuickTime movies.

■ LIKES

Professional features like VCR control and multiple key modes; instant preview; impressive selection of effects and filters.

■ DISLIKES

Filters can be applied only to an entire clip; poor interface to some features; weak titler.

■ RECOMMENDATIONS

Premiere is still the best choice for QuickTime editing, and 2.0's new features give it a broader audience.

■ PRICE

\$695 (upgrade from 1.0, \$149)

■ FOR MORE INFORMATION

Adobe Systems, Inc.
1585 Charleston Rd.
Mountain View, CA 94039
(415) 961-4400
fax: (415) 962-0850

Circle 1228 on Inquiry Card.

SOFTWARE

A BASIC Breakthrough

TOM YAGER

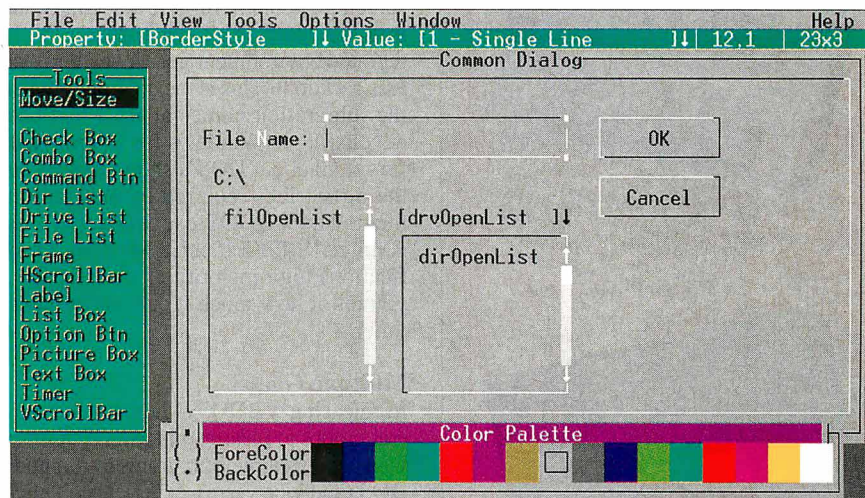
Microsoft's new Visual Basic for DOS may earn converts among those bigoted against BASIC. This is a programming system unlike any other (except perhaps Visual Basic for Windows). In one box come all the tools you need to write *serious* BASIC applications. The standard edition (\$199) features an integrated environment—editor, interface builder, debugger, compiler—and a set of interface objects for building professional-looking applications. The professional edition (\$495) adds features that seasoned Microsoft BASIC programmers expect, like ISAM (indexed sequential-access method), graphics, overlays, and 386/486 optimizations. And this package offers one feature that is truly hard to find: near-automatic conversion to Windows.

Power Tools

I evaluated the professional edition of VB-DOS on a handful of systems, including a Dell 450SE 486/50 tower and a Toshiba T2000SX notebook. This gave me a good feel for its performance. One of the most significant aspects of the program is the integrated environment. It, like the programs you create with it, delivers to a remarkable degree the Windows look and feel in text mode. If it weren't for the jumpy reverse-video block that's supposed to be the mouse cursor, the emulation would be almost complete.

Developing applications under VBDOS is a lot like using its Windows counterpart. VBDOS is a highly modular system in which each separable block of code is edited in its own window and proper programming style is *enforced*. Start a new function definition under the one you've just written, and VBDOS will instantly open a new window and move your function definition to it. If you just keep typing, you won't even notice.

This is important when you're editing large, multimodule applications. The environment knows all the function and subroutine names you've used and can pop up some named portion of your code in a flash. If your project has multiple files, VBDOS lists the files in a box on the right side of the display, so you can hop from module to module with ease. You no longer have to remember which file the function you're looking to edit is hiding



VBDOS's interface builder will set existing DOS developers to drooling. The interface elements are all "smart"; buttons know how to change shading when they're pressed, text boxes know how to handle and edit input, and so on. The interface model should look familiar: It's Windows.

in. You can have multiple edit files open at once or, to save screen space, do all your editing in a single edit window that switches from file to file.

The Big Event

VBDOS programs should be event-driven if you wish to take full advantage of the environment's power. Most events come from user-interface objects, and the interface builder is an integral part of the VB-DOS system. Interfaces are drawn in much the same way as with Visual Basic for Windows (see the screen). Double-clicking on an interface object brings up the BASIC code attached to that object. Code segments are mostly attached to interface objects' events (like mouse-clicks and key presses).

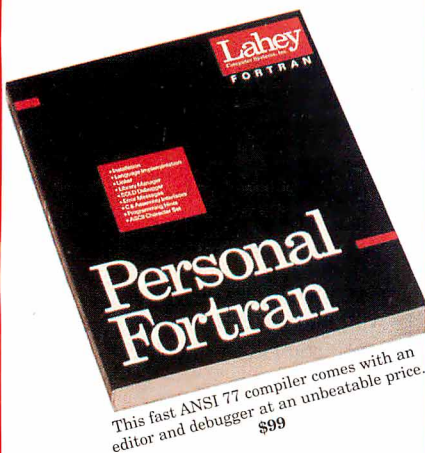
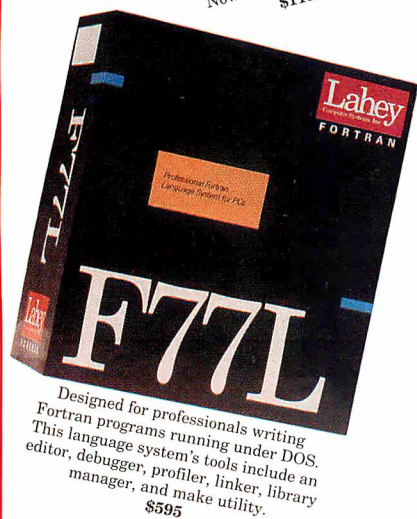
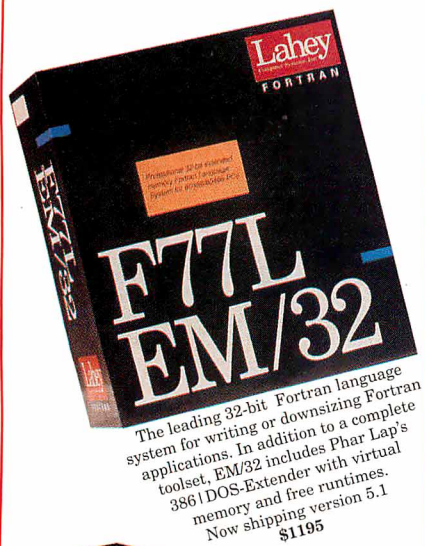
The objects are "smart"—that is, they have designed-in behavior that you don't need to program. The text object, for example, already knows how to process text. If you drop a bunch of different interface controls together in a window, VBDOS assigns a default tab order so users can move among them with the tab or arrow keys. All you really have to add is code describing the action you wish to take in response to the input events you choose to pay attention to. Any input not actively processed by your code is discarded. This is a boon for prototyping and testing interfaces as you build your application.

continued

BYTE ACTION SUMMARY

- **WHAT VISUAL BASIC FOR DOS IS**
An integrated environment for creating compiled, event-driven DOS applications with BASIC.
- **LIKES**
Suitability for all classes of programmers; Windows portability.
- **DISLIKES**
Interface support for DOS text mode only; overlays required to get past 640 KB.
- **RECOMMENDATIONS**
It's the one programming tool you can't live without.
- **PRICE**
Standard edition, \$199 (\$99 for Microsoft BASIC owners); Professional edition, \$495
- **FOR MORE INFORMATION**
Microsoft Corp.
1 Microsoft Way
Redmond, WA 98052
(800) 426-9400
(206) 882-8080
Circle 1226 on Inquiry Card.

Just Add Code.



(800) 548-4778

Free, Unlimited Technical Support
30-Day Money-Back Guarantee
Same-Day Shipping

Lahey
Computer Systems, Inc.

(702) 831-2500
Fax: (702) 831-8123
P.O. Box 6091

Fortran is our forte Incline Village NV 89450

A BASIC BREAKTHROUGH

DOS text-mode limitations on screen space and memory become apparent when you start switching between the code and interface-building portions of VB DOS. If you go from the integrated environment to the interface builder, for example, the screen goes blank for a few seconds, and then the interface builder appears. The integrated environment goes away until you exit back to it. This is the only place where the integration comes apart. I had been developing in Windows for so long that I forgot all about DOS's shortcomings and the dirty tricks required to work around them. The VB DOS executable will use EMS or XMS (Extended Memory Specification) high memory as swap space if you tell it how much it can use at launch time.

Multiple Goals

In releasing VB DOS, Microsoft has several groups to please: Windows developers who also want their programs to run under DOS (and vice versa), experienced QuickBasic and Microsoft BASIC developers, and people who don't normally write their own programs.

VB DOS directly supports taking a Visual Basic project from Windows to DOS; since the DOS version came last, Microsoft was able to build Windows file compatibility into it. To go from DOS to Windows involves either saving individual form (i.e., interface) and code module files as ASCII or running the whole shooting match through a Windows-based project translator (included with VB DOS).

All the standard interface elements are supported on both sides, and the underlying languages are almost identical. Microsoft even provides DOS clipboard and printer objects that support enough functionality to make porting go more smoothly. Perhaps more remarkably, the Windows MDI (Multiple Document Interface) is emulated. Most small projects just translate on the first try, but it depends mostly on how many Windows- or DOS-specific things you try to do. Custom controls and extensions (like ISAM) on either side are not portable, but that's to be expected. What brings it all together is the marvelous documentation: A well-written appendix covers conversion in both directions and spells out the issues.

Microsoft also goes out of its way to accommodate QuickBasic 4.5 and BC 7.x users. The manual includes a detailed accounting of the differences between Microsoft's BASIC languages (including GWBASIC) and offers lots of ways to work around those differences. QuickBasic and BC code can be loaded directly; unlike Visual Basic for Windows, the DOS

version will run virtually any old-fashioned, non-event-driven BASIC program with a minimum of adaptation. Smart programmers, however, will take the manual's advice and convert instead of copy to take advantage of the new features Visual Basic places at their disposal.

Eyes of the Beholder

The "visual" aspect of Visual Basic for DOS is more than skin-deep. VB DOS applies advanced software development techniques in a unique combination that DOS programmers haven't experienced before. I'm a Visual Basic for Windows fan, so I expected to be disappointed by the DOS version. Not only was I impressed, but I realized that VB DOS has some key advantages over its Windows counterpart. These include a native-code compiler (with optional 386/486 optimization). In addition, DOS programs have the advantage of running under Windows as well (they run very nicely in the Windows DOS box). Other benefits are the professional edition's integral ISAM database support and the software's ability to build applications into single-file stand-alone executables.

Although there's a lot about VB DOS that's impressive, it does have shortcomings. First, I would have liked better support of DOS systems running in graphics modes. This would have made some limited multifont capability available, with a trade-off in display performance (this mode can be seen in Microsoft Works for DOS). It might also have made for better support for graphical elements like icons and window border controls.

I would also like to see more transparent support for extended memory. As it is, you must resort to overlays and command-line tools (specific to the professional edition) in order to get your applications over the 640-KB hump. That makes large Windows programs difficult to port and heavy-duty DOS applications more work than they have to be.

Overall, I think Microsoft hit the nail right on the head. VB DOS adequately meets the needs of serious and casual programmers, Windows and DOS programmers, and BASIC and other-language programmers. I can't think of a class of the code-writing public whose lives wouldn't be made easier with this system. If Microsoft keeps this up, it'll give BASIC a good name. ■

Tom Yager is director of the BYTE Multimedia Lab and a proud BASIC programmer from way back (but he also writes in C). He can be reached on BIX as "tyager" or on the Internet at tyager@bytepb.byte.com.

APPLICATION

Forging a Business Tool: Three Fax Software Packages for Windows

STAN MIASTKOWSKI

I've used fax software on and off for several years, and I have usually been disappointed. It was often difficult to set up and use, and the results were mixed. In large part, Windows-based fax software has changed that. This new generation of fax software makes computer-based faxes an essential business tool.

For this review, I looked at three packages that just came out: Eclipse Fax, Caere FaxMaster, and ZSoft UltraFax. All three sell for under \$150, and they give you a good idea of the range of products (with very different abilities) available today. (The latest version of Delrina's WinFax, which is among the best-selling fax programs, wasn't finished as this review was being written. The final version should have shipped by the time you read this.)

Each of these packages lets you send faxes from your Windows (not DOS) applications by automatically installing a fax driver in Windows' printer section. As with all Windows printer drivers, you can

set the fax drivers as your default printer or use the Printer Setup pull-down menu in your Windows application to choose the fax driver.

When you want to send a fax, you choose the Print option from your application. All Windows fax packages pop up a screen where you enter the destination phone number, the recipient's name, and the subject of the message. All these packages give you the option of attaching a cover sheet and have built-in phone books, where you can store lists of names, addresses, and fax numbers.

If you want to send a quick one-page fax, all the programs offer a direct-send Memo feature. The fax driver intercepts the print output, converts it to a graphical fax image, and sends it on its way. All three packages offer automatic fax reception that you can switch on and off, but you'll need a fax modem that will receive and send faxes (not all do).

All the packages include a View feature that lets you see a fax on-screen before deciding if you want to print or store it. And each package lets you integrate an

external scanner for importing pages that aren't stored in your computer. Finally, further underlining the fact that Windows and fax software are made for each other, if you're running Windows in the enhanced mode or using a modem with its own processor (see below), you can work in an application while a fax is being received or sent in the background.

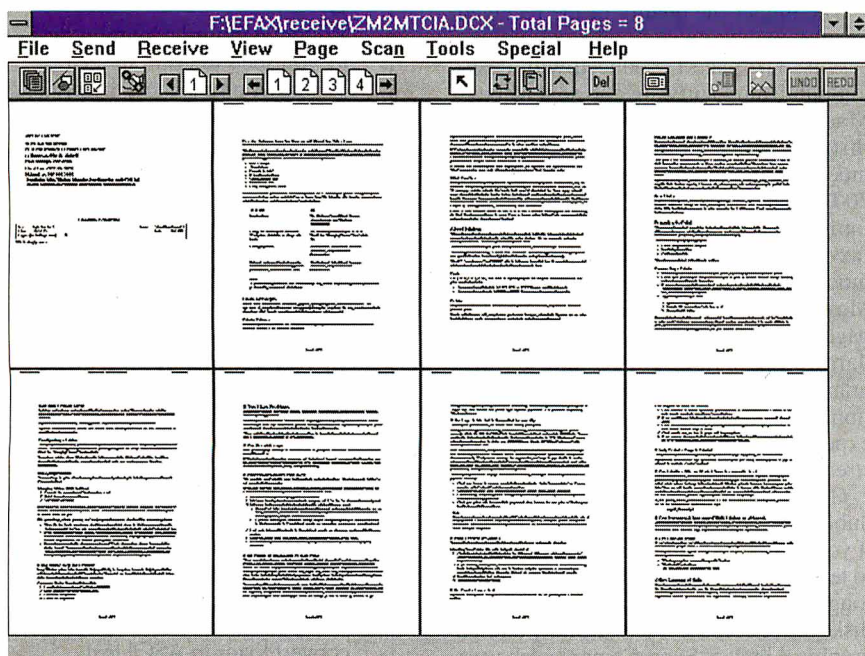
A word to the wise: Fax programs don't stand alone. It's advisable to invest in the best fax modem you can afford. If you need to fax many documents that aren't in your computer, you'll also need a scanner, which can cost more than a high-quality stand-alone fax machine. The bottom line is that the cost of a fax program is only a small part of the expense you incur when you set up a computer-based fax system. However, if they match your needs, programs like these can give you a highly integrated fax setup that can save you time and money.

I tested these fax software packages using an Intel Satisfaxion Modem/400e internal unit and a SupraFaxModem V.32bis external unit. The Intel Satisfaxion is an add-in card with its own 186 processor and RAM, taking the fax send/receive chores away from the PC's processor. It also conforms to CAS (Communications Applications Specification). The Supra unit is a class 2 (i.e., send/receive) fax modem, where the fax software communicates directly with the modem.

Eclipse Fax

When you launch Eclipse Fax, you see a plain screen with five pull-down menus. I found this simplicity useful and elegant, because you get the information you need without overloading your brain. When a fax is being received, a small screen pops up to tell you the status of the fax. Ditto for when you are sending one.

Nevertheless, there's intelligence and some unique features hidden behind the plain face of Eclipse Fax. For instance, the program offers an indexing feature that's useful if you store a lot of short faxes. When you receive a fax, you can enter a name (up to 50 characters) in the index box. It's essentially an extended filename, not a true database, but it's eminently useful. As you receive and store more faxes, you can scan through the list and quickly



Screen 1: Eclipse Fax offers a straightforward user interface and the ability to show a thumbnail of a received fax.

find the fax you want to retrieve.

Eclipse Fax's View option is fast, displaying faxes on the screen almost instantly (see screen 1). Most other packages can take from a few seconds to several minutes to go through the translation step before displaying the fax, depending on how long the fax is and how fast the PC is.

Another nice feature of Eclipse Fax is that it lets you annotate faxes in the View mode. If you want to type comments on the received fax before storing it or returning it to the sender, you just position the cursor and type away. You can also use drawing tools to mark up the fax.

Eclipse Fax uses Clearview technology. This feature removes miscellaneous spots and lines from the fax and enhances characters that didn't come through completely formed.

The package requires only a half-megabyte of disk space, the smallest amount of the three applications I reviewed and a size that allows it to work well with a portable computer. But unlike the other two programs covered in this review, Eclipse Fax doesn't include OCR (optical character recognition), so it won't translate the words in your received faxes into ASCII.

Caere FaxMaster

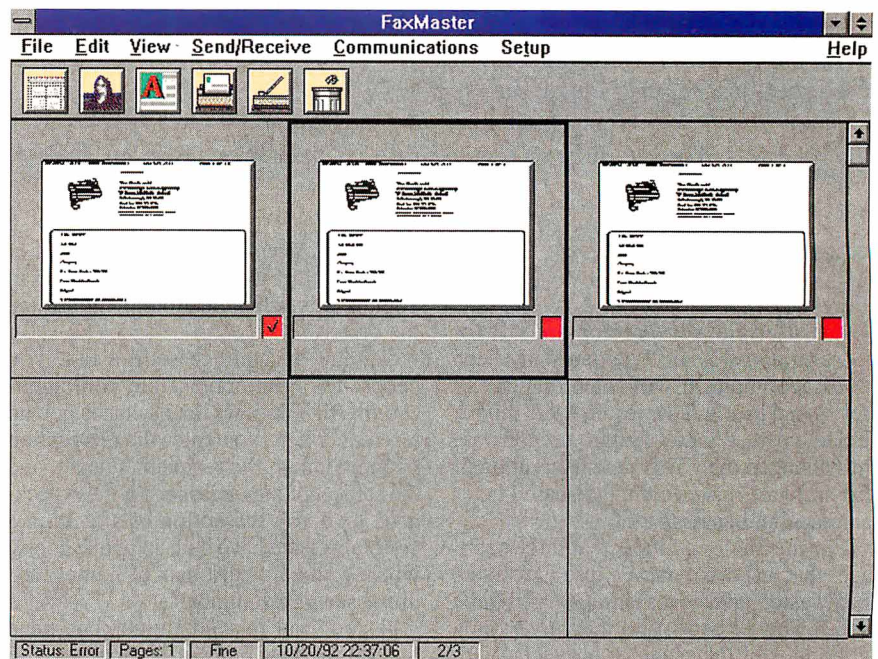
With FaxMaster, Caere is branching out from just OCR products to full-fledged applications. FaxMaster is definitely the company's flagship application.

As you would expect, FaxMaster focuses on converting received faxes into computer-readable form. If you receive many long faxes that must be edited or rewritten, FaxMaster can save you a lot of time. You can set up the program to automatically convert a fax when it's received or to perform the process later. Faxes can be converted to ANSI, ASCII, Microsoft Excel text, or Microsoft RTF (Rich Text Format). You can use the program's direct-input feature to insert a converted fax into the application (and file) of your choice.

The program's interface is highly graphical, with six icons for common operations (e.g., viewing printing, scanning, and recognizing faxes). Since many faxes are viewed and discarded quickly, FaxMaster provides a handy trashcan icon for immediate deletion. I like that. (See screen 2.)

FaxMaster requires almost 4 MB of disk space. A large part of that is the OCR engine, which Caere dubs AnyFax.

FaxMaster's image-recognition abilities are impressive. I sent it a page produced by desktop publishing software that included several fonts and various type sizes. I even tried to confuse it by placing



Screen 2: *Caere FaxMaster hides advanced abilities (including patented character-recognition technology) behind a highly integrated icon-oriented user interface.*

several graphics on the page. FaxMaster identified and blanked out the graphical images and performed text recognition with a high degree of accuracy.

However, fax conversion requires a lot of processing horsepower. The OCR process was an order of magnitude faster on my 33-MHz 486 than on a 16-MHz 286.

The higher the quality of the received fax, the more accurate the recognition process is. The page I produced with desktop publishing software and sent to FaxMaster was sent from the application through a fax modem to another fax modem using the fine mode (i.e., 200 by 200 dots per inch). FaxMaster easily performed an accurate translation with a direct fax-modem send using the standard fax mode (200 by 100 dpi). However, FaxMaster had problems with a typewritten page that was sent from a well-used standard fax machine. That's not the program's fault. FaxMaster's image recognition is impressive and useful, but don't expect miracles if it receives a noisy or streaked fax.

Caere offers a compression feature dubbed SuperCompression that's handy if you store faxes rather than convert them to text. A fine-mode fax that's a few pages long can take up a megabyte or more of disk space, because it's essentially a large graphical image. SuperCompression uses a proprietary method of compressing images. Caere claims that this feature produces a compression ratio of up to 33 to 1.

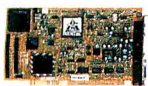
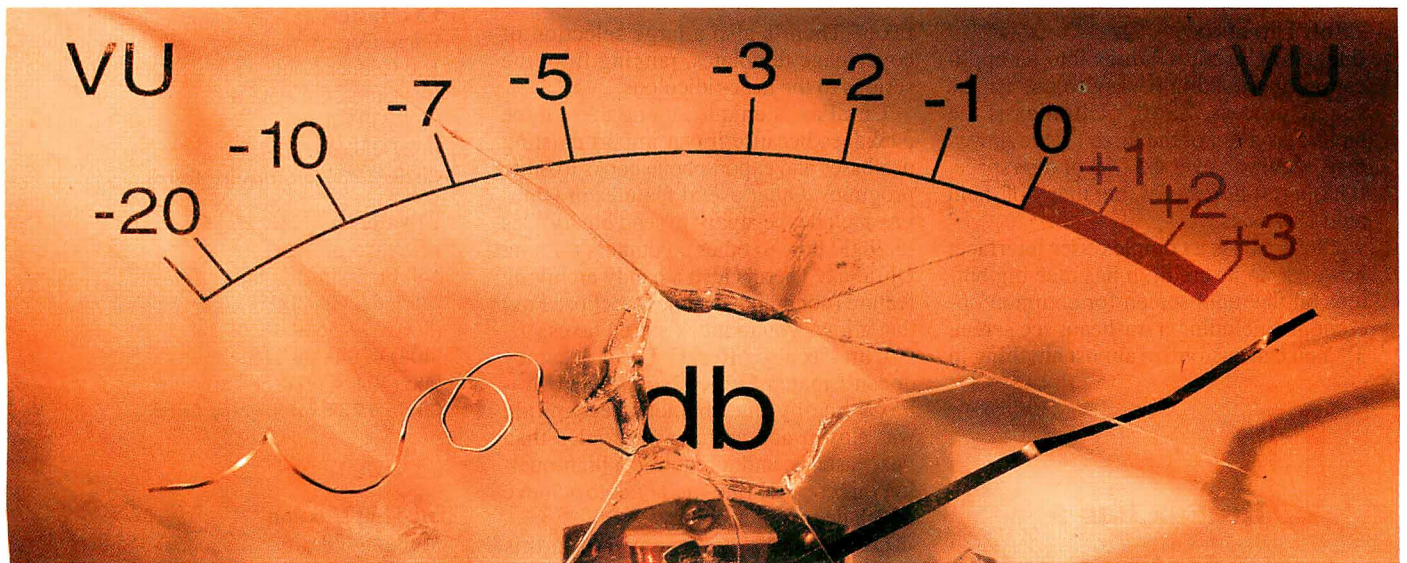
SuperCompression works, and it's useful, especially if your hard disk is rapidly running out of space, like mine.

continued

BYTE ACTION SUMMARY

- **WHAT WINDOWS FAX SOFTWARE IS**
Windows-based programs that let you send faxes from your Windows applications by printing to the fax modem. You can also receive faxes in the background.
- **LIKES**
This software lets you view faxes on-screen; some translate the graphical image of a fax into computer-readable ASCII.
- **DISLIKES**
Most programs require a large amount of disk space, and some make extensive changes to your Windows system files.
- **RECOMMENDATIONS**
Choose Eclipse Fax for simplicity and low disk-space requirements; Caere's FaxMaster excels for those who need OCR to convert faxes to ASCII text.

Allow us to crank up the volume on your PC.



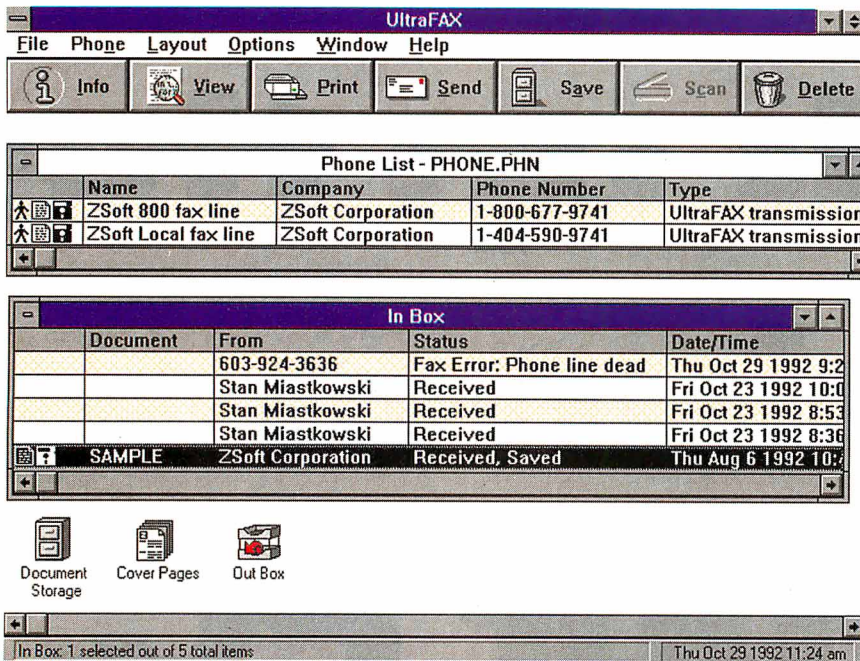
Just when you thought you had us pegged for building fiery-hot graphics cards we decide to throw a curve ball. And this one's aimed directly at your ears: the new Orchid Sound Producer

Pro. An easy-to-load board that features a phenomenal 20-voice synthesizer, delivers sampling rates up to 44.1 KHz and is 100% compatible with SoundBlaster Pro, along with three other sound standards—Disney Sound Source, AdLib and Covox Speech Thing. MIDI support, joystick port, microphone, speakers and our exclusive Voice Notes (for audio post-its) are bundled for an absurdly low \$199. For more details, call 800-7-ORCHID. Or fax: 510-490-9312. And prepare to sample true audio ecstasy.



©1992 Orchid, Sound Producer and Voice Notes are trademarks of Orchid Technology. All other trademarks are owned by their respective manufacturers.

Circle 111 on Inquiry Card (RESELLERS: 112).



Screen 3: ZSoft UltraFax integrates a lot of information on its main screen, and it includes character-recognition abilities.

ZSoft UltraFax

Integrating useful features into an application *and* making it easy to use isn't a simple process. ZSoft's UltraFax is the largest program of the three I've reviewed here, requiring over 4.5 MB of disk space. It has a raft of features, but many of them aren't obvious.

UltraFax has a complex user interface; however, to its credit, it has nice big buttons on the main screen for common operations (including a trashcan; see screen 3). You can customize almost anything in

faxes. There's also a large selection of cover-page templates, ranging from the serious to the near-ridiculous.

UltraFax is unique among these three packages because it can import existing databases and export phone books to other programs. Other useful features in UltraFax include the ability to send binary files (at 9600 bps) to other computers running UltraFax. There's also a handy archiving feature (not unlike the one in Eclipse Fax) that allows you to index stored faxes.

UltraFax also offers OCR. Its accuracy doesn't match Caere's software. UltraFax's line-by-line character recognition was slower and more easily fooled than FaxMaster's, and it required a high-quality, direct-send, fine-mode fax to achieve a high degree of accuracy.

Of the fax programs covered in this review, only UltraFax makes extensive changes to your Windows WIN.INI and SYSTEM.INI files. That's not unusual among Windows applications in general, but one of my pet peeves is installation programs that neither make backups of the Windows system files nor give you an "uninstall" option that puts everything back where it was. UltraFax does neither, and I spent a lot of time changing and cleaning up files after I finished my review.

Making a Choice

The range of Windows-based fax programs available today gives you many choices,

depending on how many faxes you send and receive and what you want to do with them.

For simplicity and usefulness, Eclipse Fax is the obvious choice. If you have to convert faxes into computer-readable text files, choose Caere's FaxMaster for its outstanding OCR technology. ■

Stan Miastkowski is a BYTE consulting editor and a freelance writer. He can be seen regularly on the "PCTV Live!" syndicated TV show and is the coauthor of Windows for Workgroups Bible (Addison-Wesley, forthcoming). You can reach him on BIX as "stanm."

ITEMS DISCUSSED

Eclipse Fax.....\$119
Eclipse Systems, Inc.
33 West Monroe St., Suite 1121
Chicago, IL 60603
(800) 452-0120
(312) 541-0260
fax: (312) 541-0514
Circle 1229 on Inquiry Card.

FaxMaster.....\$149
Caere Corp.
100 Cooper Court
Los Gatos, CA 95030
(408) 395-7000
fax: (408) 354-2743
Circle 1230 on Inquiry Card.

UltraFax.....\$119
ZSoft Corp.
450 Franklin Rd., Suite 100
Marietta, GA 30067
(800) 227-5609
(404) 428-0008
fax: (404) 427-1150
Circle 1231 on Inquiry Card.

FAX MODEMS

Intel Satisfaxion Modem/400e.....\$549
Intel Corp.
5200 Northeast Elam Young Pkwy.
Hillsboro, OR 97124
(800) 538-3373
(503) 696-8080
Circle 1232 on Inquiry Card.

SupraFaxModem V.32bis ..\$399.95
Supra Corp.
7101 Supra Dr. SW
Albany, OR 97321
(800) 727-8647
(503) 967-2400
fax: (503) 967-2401
Circle 1233 on Inquiry Card.

UltraFax has a raft of features, but many of them aren't obvious.

UltraFax, including the look and feel of in boxes and out boxes.

ZSoft developed the popular PC Paintbrush graphics program, and UltraFax has numerous graphics abilities. Just as with Eclipse Fax, you can draw on and annotate

☒ **YES!** Enter my one-year (12 issues) subscription to BYTE for only \$24.95.* I'll save 40% off the single copy price. Plus, I'll also receive BYTE's Annual Special Issue **FREE** with my paid subscription. If at any time I'm not satisfied with BYTE, I may cancel for a full refund on all unmailed copies.

☐ Payment enclosed ☐ Bill me later

NAME

COMPANY

ADDRESS.....

CITY.....STATE.....ZIP.....

Please allow 4-6 weeks for delivery. Basic subscription rate is \$29.95. (Mexico, \$29.95 payable in U.S. funds). Above rates are for U.S. delivery only. Please see table of contents for international subscription rates.

*Plus applicable state and local tax, if any.

IB32018



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

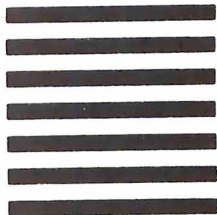
BUSINESS REPLY MAIL

FIRST CLASS MAIL PERMIT NO. 42 HIGHTSTOWN, NJ

POSTAGE WILL BE PAID BY ADDRESSEE:

BYTE

Subscription Department
P.O. Box 558
Hightstown, N.J. 08520-9409



HARDWARE

Complete Communications for Small Businesses

STANFORD DIEHL

A data modem, a fax, and a voice-mail system are three essential components for setting up communications in a small business. Instead of requiring you to install and mediate each of these devices separately, a new group of products now pack these components onto single internal PC cards. You get complete messaging systems at a reasonable cost, but can these new fax/modem/voice cards get the job done?

To find out, I evaluated two PC messaging systems: Complete Communicator Gold, a faster version of The Complete PC's flagship product; and Home Office, a new offering from Prometheus Products (I've also seen a preproduction version of a new PC messaging system from National Semiconductor; see "A National Voice for the PC" on page 67). The idea seems to be catching on.

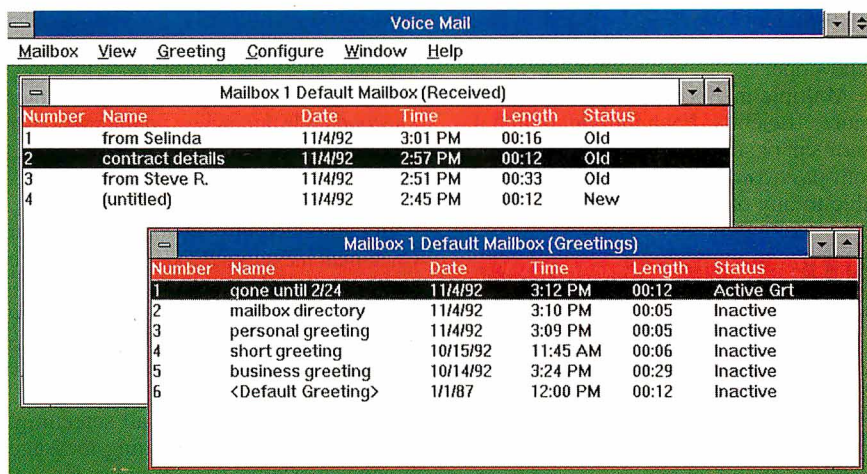
Common Ground

Both of the shipping products share basic design features. A single internal card holds a Hayes-compatible data modem offering industry-standard data compression (for file-compression rates of up to 4 to 1) and error correction, a 9600-bps Group 3 fax, and voice messaging. The modem on the Complete Communicator Gold (\$699) runs at 9600 bps. (For \$499, you can get the standard Complete Communicator with a 2400-bps modem.) The Communicator cards include a scanner port for an optional Complete PC scanner.

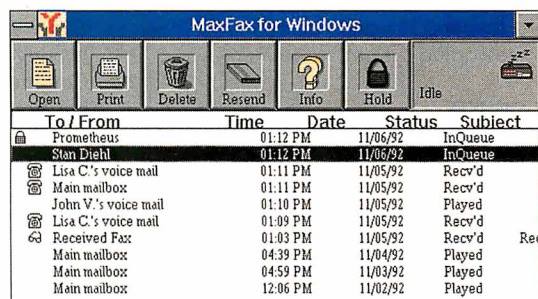
Home Office, equipped with a 2400-bps modem, sells for \$299. Prometheus also offers a version of the product with a 14.4-Kbps modem, called Ultima Home Office, but an evaluation unit was not available at press time. Ultima Home Office costs \$539 and includes the same software interface as the lower-end product.

The packages ship with fax and voice-messaging software for both DOS and Windows. A DOS communications program is also included with both products. With the Windows fax software, faxing services are available directly through a printer driver (see page 209 for a related review of Windows-based fax software).

From any Windows application, you can generate a fax job by selecting the Print option from the main menu. The driver will then load, allowing you to assign a



The Complete Communicator Gold handles fax and voice messages from two separate applications. The top screen shows the Communicator's voice-mail log and a list of greetings. Home Office (bottom) manages both fax and voice-mail messages from a single window.



recipient, select a cover page, and deliver the fax. Both products also include a dedicated fax application for tracking your jobs, examining incoming faxes, generating cover pages, and sending files directly. The hardware can sense the state of an incoming call—data, fax, or voice—and automatically switch to the proper receive mode. Fax and voice messaging operate in the background, so you don't have to interrupt your work to service calls.

The Home Office software keeps a single log of its transactions. From one window (see the screen) you can keep track of all your messages, both voice and fax. Clicking on a log entry plays a voice-mail message or loads a received fax to the viewer. The Communicator keeps voice messages and fax receipts in separate logs that must be accessed from different applications (the screen shows the voice-mail component). In fact, even within the voice-mail application, each mailbox keeps a unique log that must be opened separately, and when a new message comes in, you have no way of knowing where the new message ended up. The pop-up box alerting you of new messages should

also tell you which mailbox the message went to. The Home Office approach, offering one-stop management of all your message traffic, is more convenient, but separate logs ensure additional privacy and security.

While the Home Office software has the advantage of simpler design, the Communicator's software proved more stable and full-featured. For instance, Home Office created TIFF files that other applications could not load. A number of applications—including Conversion Artist, Image Pals, and Picture Publisher—refused to load Home Office TIFFs. In general, the software sometimes seemed incomplete, stylistically (e.g., text was not properly aligned within a box or button) and functionally (dragging an entry from the phone book to the delivery box did not work consistently).

Take a Message

Voice messaging sets these products apart from the crowded fax/modem field. Again, both products share the same basic operation but differ in design and scope. With either product, you can set up multiple voice

mailboxes and attach different greetings to each mailbox. The Communicator lets you store multiple greetings for each mailbox so that a set of customized greetings is always readily available. With Home Office, you can have only one greeting stored for each mailbox. Each time you want to change the greeting, you've got to record a new one.

Multiple mailboxes let you route calls more efficiently. Each individual in a department or small business can have a custom password-protected mailbox, available to any caller who enters the proper

Touch-Tone sequence. The main greeting could then tell callers how to reach different mailboxes. Unfortunately, Home Office supports only two levels of mailboxes. After entering a Touch-Tone code to reach a secondary mailbox, the caller can't enter another code for further routing. This limits your applications. You couldn't, for instance, have callers enter a code for product information and then have them enter a second code depending on the particular product they're interested in. You can develop this type of system with the Communicator.

Both products also let you listen to your voice-mail messages through the telephone handset or by plugging speakers or headphones into a jack on the board. The Home Office card includes an on-board speaker, but the audio quality is too poor to be useful.

Home Office supports call screening. You can listen to an incoming message through an external speaker or headphone. If you then wish to pick up the call, Home Office automatically terminates voice mail, leaving you free to talk to the caller. The Communicator has no screening feature, but you can pick up the line even after voice mail has kicked in. And the Communicator supports Caller ID, so if you have this in your area, you can screen the phone number of the incoming caller when it appears on your computer display.

Remote Access

Like the Communicator, Home Office lets you call in from a remote phone to retrieve messages from any mailbox, and both have a valuable feature called Toll Saver. If you call in to check your messages but there are no new messages to retrieve, the system will allow an extra ring so that you can hang up and avoid a long-distance charge. With either system, you can call in remotely to retrieve messages from any mailbox, as well as delete old messages from the system. But the Communicator goes much further. Using Touch-Tone codes, you can perform almost any function available from the Windows interface: selecting and recording greetings, changing passwords, and even reconfiguring the system.

The Communicator has a clearly superior feature set. You can forward a received message to another phone or create your own messages for the Communicator to deliver. For example, you could record a voice reminder of an upcoming meeting and then automatically send the message to a group of recipients. The Communicator will then dial up each recipient and play the recorded message. You can also rename the messages in your log, assigning mean-

ingful names—such as the name of the caller—to keep better track of your messages. And the Communicator can call you at another location (or call your beeper) when new messages arrive on the system.

Viable Voice Mail?

Integrating a modem, fax, and voice mail on a single adapter board sure seems like a good idea. It delivers vital communications services at an affordable price. But there are some drawbacks. Voice messages require plenty of disk space—200 KB for each minute of recorded voice. The Home Office helps some by giving you the option of recording at lower sampling rates, thereby saving disk space but degrading the audio quality. You will still need a hefty hard drive to hold a reasonable volume of voice mail. Memory resources are also taxed: The Home Office TSR program consumes just under 100 KB while the Communicator eats up about 144 KB.

Both products lack multiline support. As your business starts growing, your customers may hear a busy tone one too many times. These systems also need more programmability. In particular, the Home Office limit of only two levels of mailboxes is not sufficient when you're trying to create a customized voice-mail system. Deeper levels of mailboxes is a good start, but programmable firmware is what's needed. The preproduction TyIN 2000 card from National Semiconductor features a programmable processor. The BIOS code is downloaded into DRAM on boot-up, not held in a permanent ROM. This not only allows future upgrades (such as color fax or more advanced error correction) to be delivered via software disks, but it also enables you to customize the system with your own software code.

The limitations of these products are, for the most part, restrictions of scale. If your business is big enough to have its own PBX, these products will not do the job for you. They seem best suited to small start-ups and home offices that want to minimize equipment costs. For those businesses, the Complete Communicator Gold offers an impressive set of features and stable operation. Support for multiple mailbox levels is especially notable. Home Office carries a lower price tag, but the software isn't mature enough to recommend. There are some interesting developments to keep an eye on, but in the current market, the Communicator is still the one to beat. ■

Stanford Diehl is a BYTE Lab technical editor covering graphics software, peripherals, and add-ins. He can be reached on BIX as "sdiehl."

BYTE ACTION SUMMARY

■ WHAT PC VOICE-MESSAGING SYSTEMS ARE

A modem, fax, and voice-mail system on an internal PC card.

■ LIKES

An inexpensive way to develop a low-end fax and voice-messaging system.

■ DISLIKES

Only viable for a small start-up or home office.

■ RECOMMENDATIONS

The higher cost of the Complete Communicator Gold buys you a more stable product and a more powerful set of features.

■ PRICE

Complete Communicator Gold: \$699 with 9600-bps modem, \$499 with 2400-bps modem; Home Office: \$299 with 2400-bps modem, \$539 with 14.4-Kbps modem

■ FOR MORE INFORMATION

The Complete PC
1983 Concourse Dr.
San Jose, CA 95131
(408) 434-0145
fax: (408) 434-1048
Circle 1221 on Inquiry Card.

Prometheus Products, Inc.
9524 Southwest Tualatin
Sherwood Rd.
Tualatin, OR 97062
(800) 477-3473
(503) 692-9600
fax: (503) 691-1101

Circle 1222 on Inquiry Card.

SOFTWARE

Stacking Up TCP/IP for Windows

BARRY NANCE

Windows and Unix don't seem like a natural match, but the popularity of Windows as a client platform and Unix as a host makes finding ways to connect the two a common problem. DOS users have long enjoyed access to Unix services through products such as FTP Software's PC/TCP, but similar access through Windows (and with the Windows user interface) has been more difficult to come by.

I evaluated four products from three companies that bridge the gap between Windows and a TCP/IP environment. These four packages contain a Windows-compatible TCP/IP protocol stack, a client NFS (Network File System) component, and a collection of TCP/IP utilities. TCP/IP utilities allow Windows users to send and receive Unix mail, gain terminal access across a TCP/IP link, transfer files, run programs on another host, and join Unix print queues. NFS allows you to mount remote Unix file systems as networked PC disk drives.

The four products that I'll look at are BW-NFS 3.0 from Beame & Whiteside Software, Super-TCP for Windows version 2.00 and its companion Super-NFS Client 2.00 from Frontier Technologies, and ChameleonNFS 3.05 from NetManage. Each of these products provides at least ftp, ping, and telnet, and all of them provide a few other TCP/IP utilities. None, however, offers remote-shell functions (e.g., rexec and rsh) in a Windows interface.

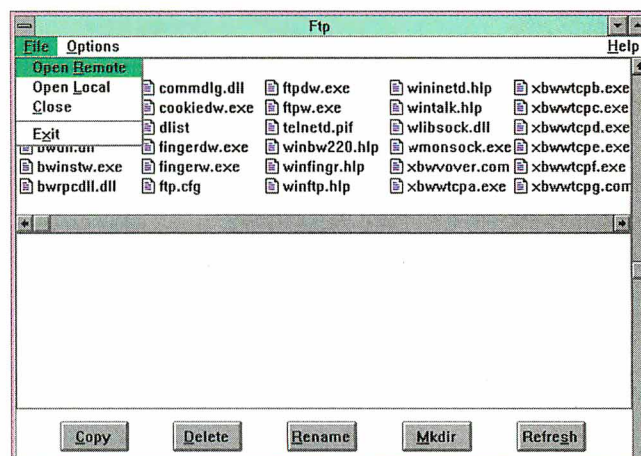
I used SCO Unix 4.0 running on an IBM PS/2 Model 80 as the host. On the client side, I used my Compudynes 4DX/33 notebook running DOS 5.0 and Windows 3.1. A Xircom pocket Token Ring adapter and its NDIS drivers provided access to the host through my token-ring LAN.

All the products installed easily, except for one minor protection-key problem with Super-TCP. BW-NFS isn't copy-protected, and ChameleonNFS intelligently uses TCP/IP messages to detect multiple copies of itself running on the LAN.

Why Windows?

Using Windows instead of a plain DOS interface to access the Unix host has several advantages. TCP/IP utilities such as ftp (which uses FTP to transfer files be-

Screen 1: BW-NFS includes an ftp console with a graphical, click-and-drag interface for moving files between file systems.



tween the local PC and a remote host or between two remote hosts) get a friendlier interface. Operations that usually require command-line entries happen under Windows in response to push buttons, check boxes, and selections from listboxes.

ChameleonNFS and Super-TCP offer a memory-saving advantage. The TCP/IP protocol stack is in a Windows DLL instead of TSR programs and device drivers. You don't have to allocate precious base DOS memory to the protocol stack.

Unfortunately, the downside of the DLL approach is that you can't access the Unix host from DOS programs. To avoid this problem, Frontier Technologies packages a TSR protocol stack with Super-TCP that you can use as an alternative to the DLL. Beame & Whiteside doesn't offer a TCP/IP DLL; it supplies only a protocol stack in the form of TSRs and device drivers.

Another advantage of a Windows TCP/IP implementation is, of course, multitasking. Multitasking allows you to more closely simulate a Unix environment, because you can run host processes that give other users access to your system while you use it for other purposes. You couldn't make this work under DOS.

BW-NFS

You can set up BW-NFS to run on any network adapter that comes with NDIS or ODI (Open Data-link Interface) drivers. You can also use it with the Crynwr (formerly Clarkson) Packet Drivers or through a serial interface (using SLIP [Serial-Line IP]).

The TCP/IP-resident portion of the BW-NFS product took 31 KB in an NDIS, token-ring configuration (in addition to

the NDIS drivers themselves). I was able to load all the resident software into upper memory with DOS 5.0, but 386Max could not load TCPIP.SYS high.

continued

BYTE ACTION SUMMARY

- **WHAT TCP/IP STACKS FOR WINDOWS ARE**
A TCP/IP stack and Windows-based Unix utilities for accessing Unix hosts from PCs running Microsoft Windows. They provide an NFS component for connecting to remote file systems.
- **LIKES**
ChameleonNFS's unique features, most notably its NFS host facility. It also has the best Windows interface to its utilities.
- **DISLIKES**
Documentation for Super-TCP for Windows; lack of remote-shell functions in any package.
- **RECOMMENDATIONS**
Get ChameleonNFS.
- **PRICE**
(Single user)
BW-NFS 3.0, \$349
Super-TCP for Windows 2.00, \$395
Super-NFS Client 2.00, \$90
ChameleonNFS 3.05, \$495

Decisions, decisions, decisions.

Decider, decider, decider.

Down-sizing, upgrading, multi-platform environments. Today's computer hardware issues are more numerous, more difficult, more critical than ever. So how do companies make decisions?

According to a new IntelliQuest study, they turn to the only person qualified to decide. Someone like Bob Barrett. A person with 18 years in computers. Who oversees a technical staff of 75. And whose buying decisions and approvals affect nearly 3,000 users worldwide.

In other words, they turn to the BYTE reader. A full 92% of whom control the products and brands their companies buy.

If you want to reach an audience as influential as this, then yours is an easy decision—advertise in BYTE.

BYTE reader Robert N. Barrett, Vice President Management Information Systems, M/A-COM, Inc.

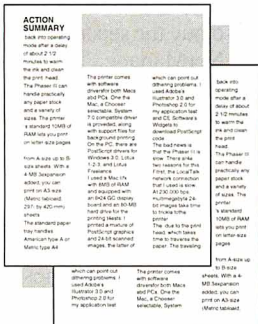
It doesn't get bought without

© 1992 BYTE, a McGraw-Hill publication. For a presentation of the March 1992 IntelliQuest study, call (603) 924-2635.



BYTE

BYTE Reprints



The BYTE Reprint

Department will

provide free quotations
for reprints of BYTE
articles.

Reprints can serve as
high quality, inexpensive
promotional tools:

- Train and educate
key personnel
- Present information at
conferences/seminars
- Provide literature to
users of your products

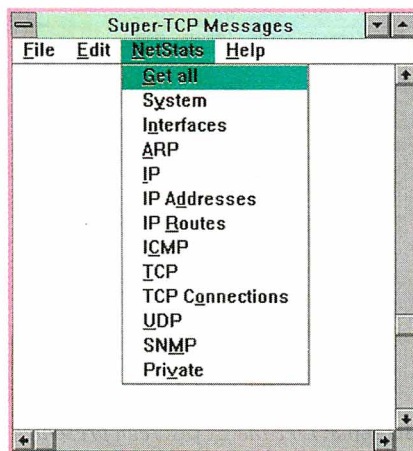
Call
603-924-2525

for information and a free
price quotation.

Minimum order: 500



STACKING UP TCP/IP



Screen 2: Super-TCP provides useful network statistics, including IP addresses, IP routes, and ARP information.

BW-NFS includes the standard utilities, `bw220w` (a Telnet VT-220 and 3270 terminal emulator), `finger`, and `talk`. The `bw220w` utility is a Windows version of the DOS character-mode-interface terminal program from Beame & Whiteside. In contrast, the `ftp` utility supports drag-and-drop direct manipulations with the mouse (see screen 1). You can, for example, copy a host file to your local hard drive by dragging a file icon from one window to another.

I wasn't able to send or receive mail with the BW-NFS software because Beame & Whiteside hadn't finished developing the mail software yet. When it's completed, you'll need to send in your product registration card to obtain the E-mail component.

You can mount or unmount NFS drives in File Manager's Connect Network Device dialog box, or you can issue a command-line mount command before you start Windows. A Windows background program, `inetd`, services requests made to your computer by other network users. You can configure the services to which `inetd` should respond (options include `ftp`, `telnet`, `finger`, and `lp`). For each authorized request that `inetd` receives, `inetd` spawns a server task on your computer.

You use the Windows-based `admin` utility for maintaining the Beame & Whiteside Telnet and FTP password files that allow or deny other users access to your PC. The `inetd` program provides almost the capability of ChameleonNFS's NFS server function.

However, `inetd` doesn't quite deliver the peer-to-peer capabilities of ChameleonNFS. Clients of the `inetd` system can

only see remote files; they can't mount and then access remote drives as if they were locally attached.

Beame & Whiteside supplies a substantial reference manual with BW-NFS 3.0. The manual needs an index, but otherwise it's complete, accurate, and easy to follow.

Super-TCP and Super-NFS Client

Super-TCP provides the basic TCP/IP utilities, including a Telnet with VT-220, VT-100, VT-102, or 3270 terminal emulation, `talk`, and `smtcp`. You also get a network printing utility and an SNMP agent.

Super-TCP's `ftp` displays side-by-side local and remote host listboxes containing filenames. One push button transfers files to your PC; a second push button transfers files to the host. Super-TCP also provides network statistics, as shown in screen 2.

The separate Super-NFS Client product allows you to mount the Unix host's file systems from your PC. You can mount NFS drives from DOS or Windows; Frontier Technologies recommends that you use File Manager to do the mounting. Remote mounts aren't quite automatic; Super-NFS doesn't support the Browse option in the Connect Network Drive dialog box, and you must remember to unmount your network drives while still in Windows or Windows will crash on exit. The TCP/IP DLL doesn't support domain name resolution.

You can configure Super-TCP as a TSR or a DLL. The TSR component took 56 KB of RAM in the NDIS token-ring environment that I have. The DLL version takes up no pre-Windows DOS memory. Super-TCP works with network adapters that come with NDIS drivers or packet drivers, and Super-TCP offers SLIP access.

The reference manual is adequate but not as useful as that of the NetManage or Beame & Whiteside products. I was surprised that the printed documentation didn't warn me, for example, about Super-TCP's copy-protection scheme. Since protection keys weren't mentioned in the manual and were only listed in a readme file, I had some trouble installing Super-TCP. Once the security and documentation problems were ironed out, however, it worked fine.

ChameleonNFS

NetManage includes a unique and very useful feature in ChameleonNFS—the ability to configure your PC as an NFS server. This means that you can share files and printers PC-to-PC, without having to connect a Unix host to the LAN. You

**Making the best
better wasn't easy,
but we did it
"AGAIN"**

*Introducing
Model 24SII DES
Printer sharing
at it's best!*



The New Model 24SII DES data exchange system is printer sharing at its best. Now network workstations, file servers, graphic workstations, and PCs can off-load print jobs at the blazing rate of 60,000cps parallel or 46,000cps serial.

If you want to eliminate the need for multiple laser printers without losing productivity, off-load network print jobs faster, or increase your printing throughput, the Model 24SII DES is for you.

Contact a BayTech representative today for more information on the best printer sharing solutions available.

- Expandable from 4 to 24 ports
- Compatible with Windows®
- Computer-to-computer communication for file transfer or modem sharing
- Up to 16MB buffer
- 1 year warranty

Because Resources Should Be Shared

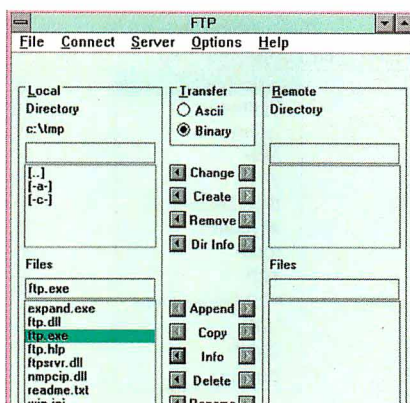


Data Communications Products Division

200 N. 2nd St., P.O. Box 387, Bay St. Louis, MS 39520
Fax: 601-467-4551 Phone: 601-467-8231 or toll-free

800-523-2702

STACKING UP TCP/IP



Screen 3: Like the ftp screen presented here, many utilities in ChameleonNFS are surprisingly easy to use.

might use this feature to set up a kind of Unix-oriented peer network. The NFS server function worked well; I was even able to mount and access a PC's drive from a Unix client.

ChameleonNFS offers telnet (3270, ANSI, VT-52, VT-100, and VT-220 terminal emulation) and mail (SMTP and POP), in addition to the common utilities. ChameleonNFS also gives you bind (which provides Domain Name Server functions) and an SNMP agent.

NetManage's NFS implementation is the strongest of the three packages. In addition to the Windows-hosted NFS server capability, ChameleonNFS supports the mounting or unmounting of network drives from within File Manager's Network Connections dialog box. When you click on the Browse button, ChameleonNFS shows you the available (exported) remote host names and directories. You click on the host name and directory to mount, enter the DOS drive letter by which you want to refer to the host's drive, and click on Connect to complete the mounting and drive-letter mapping.

If you forget to unmount a drive before you exit Windows, Windows will sometimes crash (but not always). When you do have a problem, you'll find ChameleonNFS's help files the most complete and understandable of the lot.

The ChameleonNFS utilities are well designed and make good use of both Windows and NFS. You get easy-to-use listbox and push-button access to local and remote files, and the ftp utility supports a variety of host file-system types—for example, Unix, SunOS, and others—for filenames and other directory information (see screen 3).

ChameleonNFS works only with NDIS, although it offers SLIP access through a modem. Memory-wise, ChameleonNFS

uses 6 KB of RAM for the base network driver. The rest of its functionality is in a Windows DLL.

You can use ChameleonNFS with NetWare if you also buy the separate IPX/Link product from NetManage. This lets you switch between ChameleonNFS and NetWare dynamically, without leaving Windows, with the MultiLAN driver.

Top TCP

I really liked NetManage's ChameleonNFS. The Windows utilities are easy to use, unique features like NFS host capability are extremely powerful, and I didn't even mind NetManage's approach to license-violation detection. The product is very well done.

BW-NFS is a close second, and worth a look if you are extremely price-sensitive. It's complete (I assume that the mail product will be forthcoming) and well documented. ■

Barry Nance, a programmer for the past 20 years, resides in Wethersfield, Connecticut. He is a BYTE contributing editor and the author of Using OS/2 2.0 (Que, 1992), Network Programming in C (Que, 1990), and Introduction to Networking (Que, 1992). He is the Exchange Editor for the IBM Exchange on BIX, where you can reach him as "barryn."

COMPANY INFORMATION

Beame & Whiteside Software, Ltd.

(BW-NFS 3.0)
P.O. Box 8130
Dundas, Ontario,
Canada L9H 5E7
(416) 765-0822
fax: (416) 765-0815

Circle 1223 on Inquiry Card.

Frontier Technologies Corp.

(Super-TCP for Windows 2.00 and Super-NFS Client 2.00)
10201 North Port Washington Rd.
Mequon, WI 53092
(414) 241-4555
fax: (414) 241-7084

Circle 1224 on Inquiry Card.

NetManage, Inc.

(ChameleonNFS 3.05)
20823 Stevens Creek Blvd.
Cupertino, CA 95014
(408) 973-7171
fax: (408) 257-6405

Circle 1225 on Inquiry Card.

APPLICATIONS

Correspondence That Looks Good Globally

BIRRELL WALSH

In a global market, conducting business often involves corresponding in a variety of languages. But how do you write a letter in Urdu or draft a contract in Armenian? Gamma Productions addresses these needs with Multi-Lingual Scholar, a DOS-based word processor with fonts for 63 languages and a variety of alphabets.

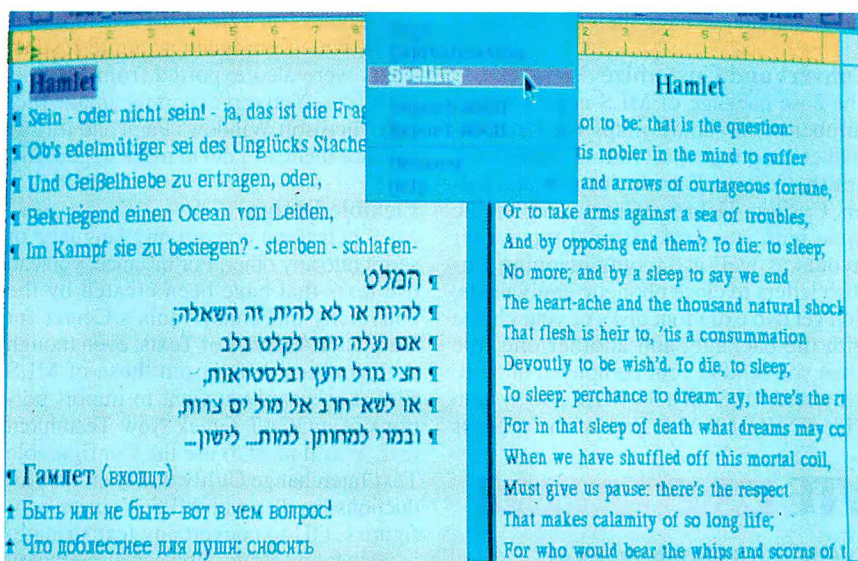
MLS doesn't translate languages; you need to know the languages or have a script. But it does provide tools for composing, importing and exporting text, creating and customizing fonts, formatting, and configuring printer fonts in almost any horizontally written script.

The benefits to using the program are documents that are correctly formatted in different alphabets, with sophisticated fonts, and free of penciled-in diacritical marks. I first learned about MLS when I needed to include passages of Greek, Hebrew, and Sanskrit in the same document. I was able to switch smoothly between languages with a few keystrokes. Each character set is so well implemented it was as if I were working in a dedicated word processor for that language. To my knowledge, it is the only program available for writing in many rare tongues.

The price you pay is that you must negotiate a nonstandard graphical interface. You must learn the program's way of implementing style sheets. You must also master the setup process if you want to use an unusual configuration.

Who can benefit most from MLS? Primarily business, government, and academia. Most of the languages MLS provides are modern, like Thai and Hindi, but it offers some ancient ones like Syriac (although a typical businessperson won't usually need to write in an ancient language). If you have on staff a person literate in those languages, you'll be able to produce good-looking business documents in MLS.

If you are doing business with a foreign country, you'll need to work with governments, and some governments might also be using MLS. The Canadian government, for example, bought the program to write in Inuktitut, an Eskimo language with its own alphabet. Voice of America uses MLS for its field correspondents, and the BBC uses it in London for its foreign-language journalists.



Multi-Lingual Scholar has fonts and formats for 63 languages and many alphabets.

Alphabets from A to Z

In addition to the English alphabet, the basic package includes the Arabic/Persian, Greek, Cyrillic, and Hebrew alphabets. With these, and by purchasing additional fonts (beginning at \$50) from Gamma Productions, you can write in more than 60 languages, including Arabic, Croatian, the International Phonetic Alphabet, Russian, Thai, Urdu, and Yiddish. All the fonts I have seen are handsome when laser-printed and are suitable for camera-ready copy.

When you first start a document, the languages available are listed in the style menu. When you are writing in English, MLS functions like a traditional word processor. When you switch to another language, the program loads a new screen font and a new keyboard map. Style sheets can include language choice as well as formatting commands, so you can load a new language, style, and font with three keystrokes. When you print your document, MLS downloads the fonts. I find it easy to work in two or three languages in one document. The only problem is learning where the keys for characters are located.

Almost every language in the Latin alphabet includes unique characters, accents, or diacritical marks not found in most American-born word processors. MLS has them all, in addition to its non-Latin alphabets. Third-party foreign language fonts designed for Windows or for WordPerfect and other word processors may be fine for

writing in one language at a time, but if you need to switch back and forth between languages, MLS handles the details beautifully.

You can have up to 10 working languages in one document and 16 fonts per page. When you switch between languages, all the rules switch as well. For example, if you embed Hebrew in an English document, MLS knows the Hebrew text is written from right to left. If the Hebrew is contained within an English paragraph, the Hebrew flows from right to left but the rest of the text remains aligned to the left. You can also override the automatic formatting.

In many languages, the placement of vowels and accents varies depending on surrounding consonants. Placement in reference to the baseline varies as well. In Hebrew, Arabic, and Hindi/Sanskrit, vowels may occur above, below, after, and even before consonants they follow in speech. MLS treats these vowels as overstrikes assigned to function keys or as specific character pairs assigned to one key.

MLS manages other features that have no equivalent in European languages. For instance, in Arabic and Hebrew, some letters have different forms depending on whether they're initial, final, stand-alone, or embedded. MLS checks for the position of the letter and chooses the appropriate character form. MLS also handles "kashideh" justification. Whereas most

Western languages justify text by adding space between letters and words, Arabic and some North Indian alphabets justify with extended lines within words. Exemplifying this technique are the long loops of Arabic or the overhead lines from which Indian languages hang their characters.

Convert and Customize

The base package of MLS comes with a number of keyboard maps for Latin-alphabet languages, including American, British, German, French, Spanish, and Italian. Cyrillic, Hebrew, Greek, and Arabic come with standard national typewriter layouts as well as layouts mapping English letters to close phonetic equivalents. You get two extra font disks of your choice with the package, and another one free when you send in your completed tutorial.

I tested MLS on a 33-MHz 386 system with 4 MB of RAM. Part of the process

included editing blocks of several languages, often within one paragraph, including fifth-century B.C. Sanskrit and Hebrew, and Greek from a thousand years later. The program maintained correct formatting for each language. Then I printed the blocks on a Hewlett-Packard LaserJet II, which produced accurate results. Texts were also exported from MLS as PCX files. You can export the image files into Microsoft Windows Paint and further enhance them, as I did to make large signs.

Flexible Design

MLS helps you convert any language or script into any other. For instance, you can use texts that have been created by the University of Pennsylvania's Center for Computer Analysis of Texts, even though their formats differ from those of MLS files. Let's say you want to import portions of a CCAT Greek New Testament text. You'll need to use the Configurable Text Interchange Utility that Gamma Productions bundles with MLS. You can configure CTIU to convert any text string to any other text string. You can also employ it to design any conversion—including formatting codes—that can be coded into 8-bit bytes.

Every feature of MLS is designed to be redesigned. You can customize the fonts, rules, and formatting to almost any degree you wish. If Gamma doesn't sell the language you want, you can build a font for it with Font Scholar, a program for creating fonts that's also included with MLS.

To build a font, you can either use Font Scholar's graphics tools or scan in an alphabet and attach characters to keys with a keyboard map. Either way, it takes time to build a font. You can also define the rules governing the language: text flow from right to left or left to right, contextual character forms, type of microjustification, and import/export conversion codes.

Almost WYSIWYG, Almost Universal

If all these features seem too wonderful to be true, be aware that there are some shortcomings to the current version of MLS. One is the inability to write in either Chinese or Japanese. Both languages are often written vertically, and both use thousands of ideographs rather than a phonetic alphabet. The myriad characters cannot be encoded adequately in the 256 possibilities of an 8-bit byte (see "In the Land of the Double Byte," October 1992 BYTE).

Another drawback is that the MLS interface is poised about midway between early-1980s word processors and today's desktop publishing packages. What you see is *almost* what you get. Columns do

not appear on the screen, but typefaces and styles are shown. Also, MLS's interface is an island unto itself in a world that is increasingly standardizing on Windows. However, MLS lets you create style sheets that include language choice as well as font, type attribute, justification, line spacing, and indentation.

The program gives so much that you want it to give more. Many of the languages are found nowhere else; in these cases, you would need to use MLS as a desktop publisher, perhaps to publish a catalog in five Indian languages to reach the subcontinent's huge market. But in this version, you would have to paste graphics in by hand.

Fortunately, Gamma Productions is working on a Windows version, to be called UniVerse, scheduled for release early this year. The Windows version will support embedded graphics and vertically written languages. Gamma Productions is also promising to support Unicode. Unicode is a proposed 2-byte standard; 65,536 possibilities will allow encoding of *all* the major world languages, including Chinese and Japanese. With Unicode compliance, the infrastructure to build character sets for Chinese and Japanese will be in place, but Gamma Productions is not expecting to release these character sets before late 1993, when a scalable font of many thousand Japanese characters may be ready for publication.

Gamma Productions is also shifting its focus from bit-mapped to scalable fonts. Current bit-mapped fonts will continue to work, but so will TrueType and Adobe Type 1 fonts. Font Scholar, which produces only bit-mapped fonts, may no longer be bundled with MLS. The company is also devising a licensing system for developing Unicode-compliant software (before Unicode compliance becomes universal in Windows NT). A Macintosh version is also in the works for late 1993.

Multi-Lingual Scholar 4.01 for DOS is a very good word processor if you need to work in one or more of the supported alphabets. Scholars and businesspeople will have no trouble creating multilanguage documents. If you need to develop your own font for a language not usually supported by word processors, MLS is an extraordinary bargain. ■

Birrell Walsh is a contributing editor for MicroTimes Magazine and a doctoral student in religion and philosophy at the California Institute of Integral Studies, where he works in Sanskrit, Hebrew, and Greek. He can be reached on CompuServe at 72466,3567 or on the Internet at birrell.well.sf.ca.us.

BYTE ACTION SUMMARY

■ WHAT MULTI-LINGUAL SCHOLAR 4.01 IS

A DOS word processor with support for 63 languages, up to 10 at once.

■ LIKES

MLS handles the complexities of many languages and switches between languages easily.

■ DISLIKES

This version does not support vertically written languages or embedded graphics; no Japanese or Chinese.

■ RECOMMENDATIONS

MLS is an excellent choice if you need to work in any of the languages supported. For some rare languages, it is the only choice.

■ PRICE

\$695 (Roman, Arabic, Hebrew, Greek, and Cyrillic alphabets are included; additional fonts, \$50 and up.)

■ FOR MORE INFORMATION

Gamma Productions, Inc.
710 Wilshire Blvd., Suite 609
Santa Monica, CA 90401
(310) 394-8622
fax: (310) 395-4214

Circle 1234 on Inquiry Card.

Retooling a Classic

TOM THOMPSON

This issue introduces version 2.0 of the BYTE Lab's low-level Macintosh benchmarks (see "New Tricks for Slow Macs" on page 198). The Macintosh low-levels, like their DOS counterparts, evaluate video, disk I/O, CPU processing speed, and floating-point performance. The benchmarks consist of a suite of small applications, each of which exercises a particular subsystem. For example, to measure the Quadra 950's disk I/O performance, we launch the Disk I/O application and wait while the code automatically times itself creating and writing files. When the test ends, we log the result and launch the next test application.

Our first Macintosh benchmarks—the first by a computer magazine testing lab—were written in July 1988; we used them to evaluate the Mac IIx. It's a tribute to good software design that the benchmarks survived several major revisions of the Mac OS and were used to measure the subsystems of the Mac IIvx, PowerBook Duo 230, and PowerBook 180.

Having said that, I also have to admit that we had to log test results by hand. Problems cropped up when Apple began introducing new computers in batches. Benchmarking one or two new Macs was easy, but testing five or six Macs at once and manually logging the results was an endurance test. I still remember a marathon session at Apple lasting over 4 hours during which Bruce Gee, the PowerBook product manager, helped me run the low-level tests on the then-new Mac PowerBooks, Quadras, and Classic II. Thus, out of necessity, the new tests were born.

The applications were originally created using a Small-C cross compiler written at BYTE that ran on a PC. We'd write Small-C code on the PC, and it would generate a file of 68000 assembly language instructions. This file would be copied to the Mac and assembled into a stand-alone application using Consulair's Macintosh Development System assembler. We chose Small-C as the code generator because it avoided a controversy raging at the time regarding how various compilers optimized benchmark code. Because Small-C didn't, it made the issue moot. To use Mac Toolbox traps, we wrote in-line assembly language glue code, since Small-C—written for CP/M by Jim Hendrix—had no idea

Introducing the BYTE Lab's updated Macintosh Benchmarks

what a Mac was, much less how to create calls for the Mac OS.

We then set our sights on producing the latest version of our Macintosh benchmarks. Since the old test code was still proving its worth (it detected the floating-point performance boost of Omega SANE in System 7.0.1 and also detected that the Mac IIvx used a 16-MHz bus), we planned to reuse as much existing code as possible. The real design priorities became to produce crash-free code and make the tests easier to run. Dealing with these demands meant abandoning the Small-C cross compiler. First, it was out of date, and second, putting a friendly interface on the benchmarks required using lots of Toolbox calls.

I chose Think C for the job because it's small and fast as Mac development tools go, it provides comprehensive Toolbox access, and it supports the use of in-line assembly language. This let me port the existing benchmark code with its mix of C and assembly language instructions. I also had a proven application code skeleton written in Think C.

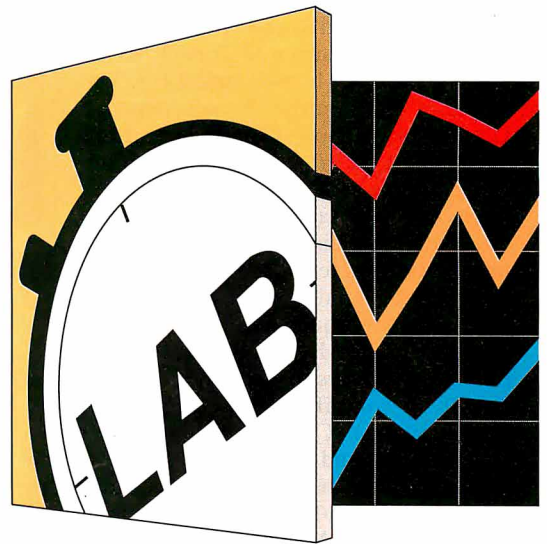
Of course, the job wasn't as simple as it sounds. There were the usual headaches revising the Small-C code, which used ancient header files, to conform with Think C's header files. The assembly language sections—especially the SANE macros for the floating-point benchmark—required some work too. Missing a small detail here caused all sorts of crashes. To get the first benchmark to operate, I had to go into hack mode and walk through the code instruction by instruction in a low-level

debugger while watching the registers and stack to isolate the problem. Jasik Design's The Debugger was handy when I rooted out trouble at this level. Once I had discovered that Small-C passed function arguments on the stack the reverse from the way Think C did, it took little time to get the first benchmark—quickly followed by the others—in operation.

The final design of the new benchmarks is that of a single application that runs and times the tests. You can run all the benchmarks (the default), a suite of tests (e.g., the video I/O), or a mix of tests. Results are displayed in a window, or you can save them as a log file on disk. Because most tests dropped into assembly language code, many of the times are close to the version 1.0 times. The exceptions are the Sort, Sieve, and TextEdit, whose results changed because they were written entirely in C.

Now, testing a Mac just requires that you launch one application, make a menu selection, and let the program do the rest. Will these benchmarks hold up as long as the originals? Perhaps. But with Apple releasing more and more Macs, and the PowerPC coming down the pike, I expect I might have to work on them again in the near future. ■

Tom Thompson is a BYTE senior technical editor at large with a B.S.E.E. from Memphis State University. He is an associate Apple developer. You can reach him on BIX as "tom_thompson," on AppleLink as "T.THOMPSON," or on the Internet at tomt@bytepb.byte.com.



BOOK

AND CD-ROM REVIEWS

HUGH KENNER

Only last July, this space was shared between *Hard Drive*, all about Bill Gates, and *Accidental Empires*, in which Gates's Microsoft, IBM, and Gates himself ranked 1, 2, 3 in length of index entries. So why another Gates book so soon? Chiefly because it gets us past the *Hard Drive* fixation on temper tantrums and dandruff. If Bill Gates merits more than tabloid attention, it's because he helped reinvent the desktop computer industry, a feat that Manes and Andrews understand as their *Hard Drive* precursors never quite did.

ROM and RAM, bit and byte, DOS in numerous flavors or GUI, interpreted BASIC or compiled—the current that gives meaning to Chairman Bill's life has streamed past and around such markers. From about the middle of their long book, Manes and Andrews help us sense the force and purpose of that current, as it drives interactions with IBM, with Apple, with a calculated future.

Knowing what jargon words mean, they've been able to talk profitably with more than 300 sources. That's something you can do only if your source senses there's a language in common; otherwise, you'll pick up just what it's easiest for the source to brush you off with—namely, gossip. About half the informants “gave us hours of their time—a full workday in more than one case.” The rest granted access by phone for up to an entire evening. All that solid information does show.

Something else, and our authors well know how this can be tricky: Bill Gates himself granted interviews, hours of them. As one of their contacts asks, “Is this an authorized biography or an honest one?” An afterword, some 3000 words called “Full Disclosure,” addresses that topic in such detail that we soon find that we're being told who paid for which lunch.

Briefly: Early in 1991, the authors called Microsoft PR and got rebuffed. Three months later, a Seattle paper (not the one Paul Andrews writes for) launched a series on Gates



AGAIN THE SWINGING GATES

Gates, Stephen Manes
and Paul Andrews, Doubleday,
\$25, ISBN 0-385-42075-7

(A recurrent theme in the book: What you do about Bill's screaming fits is stand up to them. He ends up subsiding into exhausted respect.)

And the upshot: dozens of rechecks, corrections of a few “horrible errors,” and some “minor gaffes”; but “the vast majority of other items” let stand. I'd not summarize that story in such detail did it not make starkly plain the suspicious and litigious climate in which elucidation must send forth its shoots. Not the least suspicious party is apt to be someone like you or me, wondering about bribes and PR.

Anyone interested in the multimillion-dollar phenomenon called Windows, and why it was years getting shaped into anything usable, and what were the details, meanwhile, of Microsoft's frenzied interactions with Apple and IBM, need look no further than this book. If we're stuck with Windows, seemingly, the way we're stuck with the QWERTY keyboard, how that came about still makes an engrossing narrative. ■

Hugh Kenner is Franklin and Callaway Professor of English at the University of Georgia. His recent books include Mazes and Historical Fictions. You can contact him on BIX as “hkenner.”

THE INFINITELY SMALL

Nanosystems: Molecular Machinery, Manufacturing, and Computation,
K. Eric Drexler, Wiley-Interscience, \$24.95,
ISBN 0-471-57518-6.

Imagine a world of manufactured devices so small that the designer must specify the order and arrangement of atoms in the finished machines. Consider systems so finely tuned that their operation is performed through the making and breaking of single chemical bonds.

Creating such worlds has been the decade-long quest of K. Eric Drexler, president of the Foresight Institute. His latest work, *Nanosystems: Molecular Machinery, Manufacturing, and Computation*, is a scholarly review of the phys-

ical and chemical concepts that may one day enable the production of desktop nano molecular devices.

Drexler's book is a return to first principles—the design of levers, ratchets, gears, springs, and pistons. Except, at the nano level, we now need to be concerned about the stiffness and tensile strength between individual molecules. Once the basics are understood, you can move on to the complex machines, such as a six-legged tool positioner composed of 3 million atoms and able to move approximately 100 nanometers. My favorite chapter describes the design of basic logic gates for a mechanical computer. The book includes the design of a finite-state machine theoretically capable of reaching over 1000 MIPS.

Nanosystems is not a light romp through the world of the future. It is a scholarly examination of how this technology works, a reference book for the crafters of the future.

—Raymond GA Côté

THE NETWORK FRIEND

Support on Site for Networks, \$1495,
Computer Library, 10 Park Ave.,
New York, NY 10016, (212) 503-4400.

Support on Site for Networks is a hodgepodge of books, manuals, diagrams, compatibility reports, and technical notes for LAN administrators and network troubleshooters. Its interface and search engine will be familiar to users of the popular Computer Select product. Books include the M&T troubleshooting series on LAN Manager, NetWare, and internetworks, along with Stephen Saxon's *Running Windows on NetWare*. Vendors that have provided software and hardware documentation include Banyan Systems, 3Com, Advanced Logic



C D - R O M

Research, Cabletron Systems, IBM, Microsoft, Novell, SMC, Synoptics Communications, and Thomas-Conrad. Software vendors are well represented, but coverage of NIC (network interface card), hub, and router products is quite spotty.

The disc includes nearly 3000 compatibility reports and nearly 17,000 technical notes that are the real meat of Support on Site for Networks. In how many cases would you find a solution in a relevant technical note? For BYTE's 50-node Mac/PC/Unix LAN, the answer would seem to be "not many," and I doubt that I could justify \$1495 for a one-year (12 updates) subscription. If you manage hundreds or thousands of nodes, on the other hand, there's a good chance you'll want a copy of this within reach.

—Jon Udell

CONTROVERSIAL WINDOWS

Undocumented Windows, Andrew Schulman,
David Maxey, and Matt Pietrek, Addison-Wesley, \$39.95,
ISBN 0-201-60834-0.

Few trade books have inspired such a swirl of controversy. When *Undocumented Windows* appeared last fall, Microsoft bashers pounced eagerly on passages that showed how Microsoft's tools and applications exploit undocumented Windows APIs and data structures. Microsoft, under FTC scrutiny for such practices, retaliated with a massive press release describing documented alternatives to these APIs and data structures. The company further claimed that its programmers gained nothing by their use of undocumented features and even, in some cases, suffered for their backdoor tricks. This perverse argument provoked Schulman to dig up more evidence—far more damning than what's actually in *Undocumented Windows*—that Microsoft's applications programmers do profit by their special knowledge of Windows internals.

This juicy scandal has undoubtedly spurred sales, but that is hardly a reason to buy the book. Read it, instead, for its remarkable insights into the architecture of Windows and the nature of Windows programming. The conventional view is that Windows is—and should be—a set of mysterious data structures wrapped in an enigmatic function-call interface. While such information hiding can be useful, there are also good reasons to know something about the real objects (e.g., window structures and device contexts) that lie behind the veil (e.g., *HWNDs* and *HDCs*).

The discovery of these secrets took a large amount of excellent detective work. Using commercial debuggers and disassemblers, along with an impressive collection of home-grown tools (included on the accompanying disk), the authors patiently strip away Windows' veneer of mystery to reveal a complex, sometimes wacky, but ultimately coherent work of software engineering. Some of the undocumented functions they unearth will be of general use to Windows programmers. For example, *IsWinOldApTask* distinguishes between DOS and Windows tasks. Other undocumented functions, like the infamous *TabTheTextOutForWimps*, are

included just for completeness.

Although it's packed with dense technical detail, the book is a surprisingly good read. The rocket science is leavened with a healthy dose of humor. On WinWord's mishandling of the idle interrupt: "Where's a decent monopoly when you need one?" On event-driven programming: "Only the size of the manuals has changed...it's really just good old interrupt handling in yuppie attire." Like its predecessor *Undocumented DOS*, *Undocumented Windows* is an instant classic.

—Jon Udell

ODE TO OBERON

Programming in Oberon, Martin Reiser and Niklaus Wirth, Addison-Wesley, \$19.95, ISBN 0-201-56543-9.

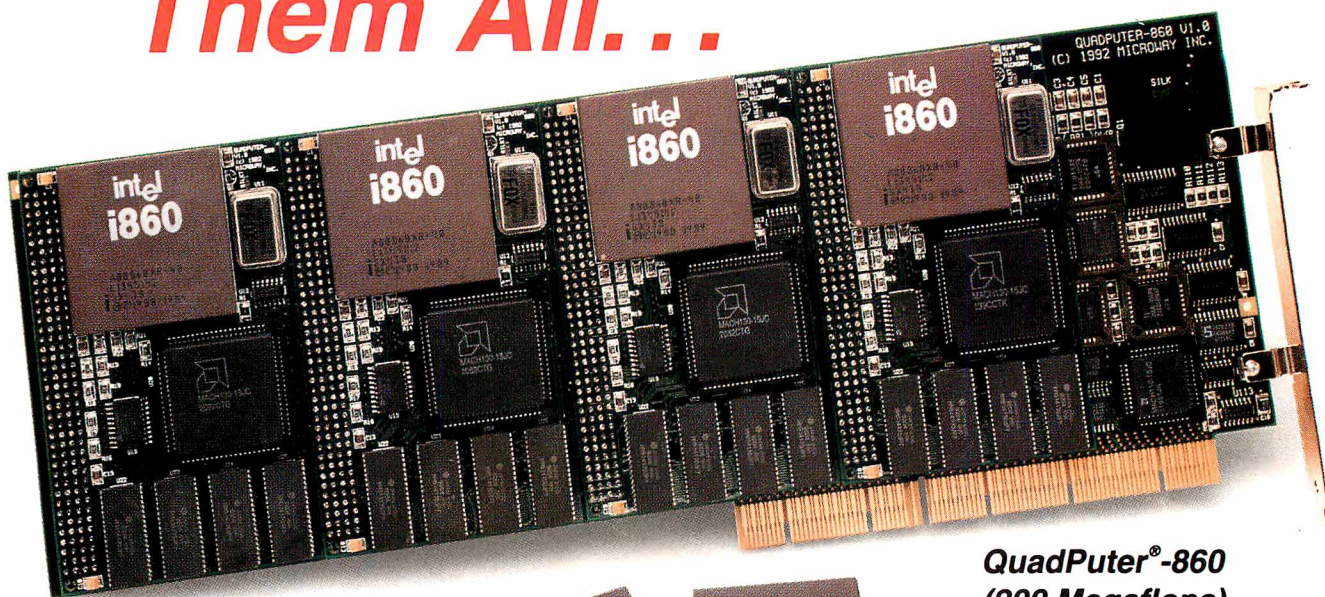
Oberon is Niklaus Wirth's latest programming language, the successor to Modula-2, which in turn succeeded Pascal. Wirth quotes another famous Swiss, Albert Einstein, in pronouncing Oberon "as simple as possible but not simpler." This book is a tutorial and language reference for Oberon and its elegant GUI operating system. The style is lucid and authoritative, and the programming examples are not the familiar 10-line clichés, but weighty topics like a discrete-event simulation and the Oberon graphics editor.

Throughout the text, Reiser and Wirth draw attention to questions of program correctness and proof, but without introducing too many unreadable formalisms. Chapter 12, "Object-Orientation," offers the best, most jargon-free overview of what OOP (object-oriented programming) really involves that I've read anywhere. It contrasts two possible OOP approaches in Oberon, using type extensions with methods implemented as either procedure variables or handlers. Wirth has mellowed his previous skepticism toward OOP and describes Oberon-2, an upwardly compatible extension that provides a true class mechanism via type-bound procedures, with a syntax not unlike Object Pascal.

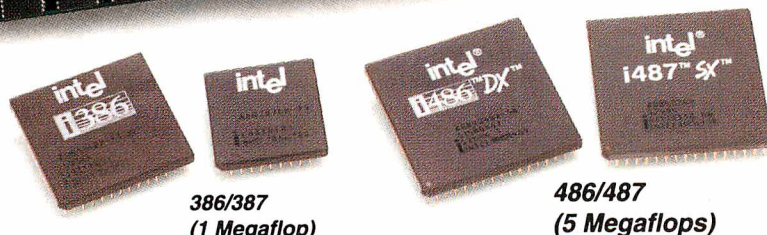
Next time swatting the bugs in your C++ project gets you down, buy this book for a glimpse of a better world.

—Dick Pountain

NDP™ Fortran Drives Them All...



**QuadPuter®-860
(200 Megaflops)**



**386/387
(1 Megaflop)**

**486/487
(5 Megaflops)**



Extended DOS • OS/2 • NT • UNIX V.3/4 • Solaris • Coherent

NDP Fortran has been the leading 32-bit PC Fortran since its introduction in 1987. It produces the highest quality numeric code and supports virtually all x86 operating systems, processors and numeric devices. These are just a few of the reasons it was used by hundreds of ISVs to port their 3090, VAX and Cray codes to the 386. NDP Fortran is required to run packages from IBM, Aspen Technologies and Fluid Dynamics. IBM chose it to port their Optimization Subroutine Library to DOS and more recently OS/2. Aspen Plus, the world's leading thermo/chemical-process control software package, is the standard employed by corporations like DuPont. Every copy of Aspen Plus for the PC ships with NDP Fortran-486!

One reason NDP Fortran is still the 32-bit leader is tools. It runs with native tools on UNIX, OS/2 and NT. For DOS, Microway created 32-bit tools that were tuned to the needs of our customers. These include efficient demand paged virtual memory for our Extender and a linker that could handle a 20-megabyte library without going to sleep. We are the only vendor that provides a variety of numeric runtime libraries that make it possible to tune speed against

precision and error recovery. The correct choice of a library vs inline intrinsics can result in a factor of three increase in speed for some applications. Then there is the issue of numeric code quality. NDP compilers are not only globally optimized, but take good advantage of the Intel 387/487 stack, use advanced numeric optimizations and schedule instructions - all of which favor fast numeric and RISC devices like the 860 and 586.

Finally, Microway customizes its compilers to the environment. Our DOS 386/486 product includes over 1,000 pages of documentation, 300 of which are devoted to our GREX™ graphics extensions. The 200 megaflops of our QuadPuter-860 are optimally harnessed using NDP Fortran-860, libraries from IMSL, NAG and KAP and the PSR Vectorizer. Microway can build you a gigaflop NFS computational server using five QuadPuters housed in our industrial grade 486-B³ for just \$50K - massive power without massive price. **If you plan to use a 386, 486, 586 or 860 and require portability, numeric speed, precision and technical support, then NDP Fortran, C/C++ or Pascal is the only solution.**

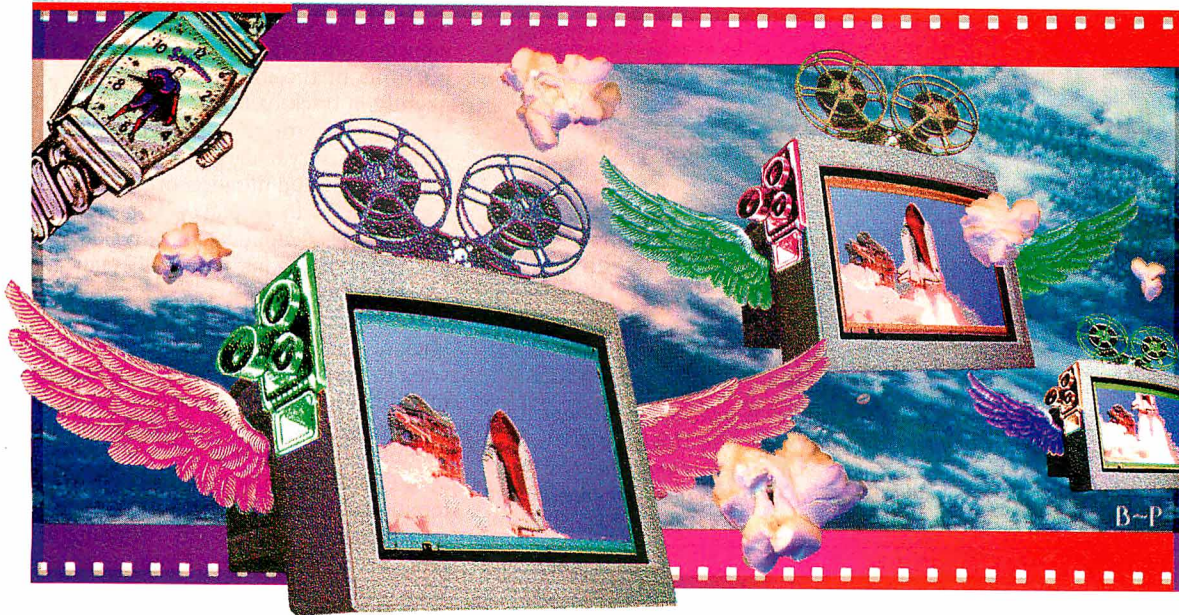
Please call our UK office to register for NDP '93 - Microway's i860 and Compiler Products Seminar in London on Feb. 17, 1993.

Microway®

Technology You Can Count On

Corporate Headquarters, Research Park, Box 79, Kingston, MA 02364 USA • TEL 508-746-7341 • FAX 508-746-4678
Kingston-Upon-Thames, U.K. 081-541-5466 • Germany 069-752023 • Greece 30 12915672 • Japan 047 423 1322 • Poland 22-410041

THE MAC GOES TO THE MOVIES



QuickTime is Apple's multimedia software standard. A hardware-independent extension to the Mac OS, QuickTime integrates time-based dynamic data types, such as sound, video, and animation, into applications as digital *movies*. As this term implies, QuickTime manages events that happen over time in much the same way that QuickDraw manages still images. Just as PICT graphics enhance presentations, QuickTime movies add a new dimension to communications, presentations, simulations, and decision-support applications.

In addition to being the foundation developers use for creating multimedia applications on the Mac, QuickTime gives users a standard way to display, compress, copy, and paste time-based data. QuickTime follows Apple's philosophy that such data should be incorporated as a standard data type and you shouldn't have to be a *multimedia professional* to create multimedia documents. QuickTime is hardware independent, which allows for the development of QuickTime software for non-Mac computers. Apple began shipping a version of QuickTime for Microsoft Windows as this article went to press.

The QuickTime Architecture

QuickTime consists of four major components: system software, file formats, Apple compressors/decompressors (called *codecs*), and human-interface standards and utilities (see figure 1). The system software has three

subcomponents: the Movie Toolbox, for the creating, editing, and playback of movies; the Image Compression Manager, or ICM; and the Component Manager. We'll discuss these three components in detail later.

A *movie* is a container for all types of dynamic data. It can be used for such things as a presentation slide show, an animated bar chart, a montage of images and sounds, or a dynamic graph of laboratory data. Movies contain references to groups of homogeneous data, such as video or sound, that are organized into *tracks* (see figure 2). Tracks don't contain the data, but instead reference actual data files on videotape, disk, and other media. QuickTime synchronizes these tracks when it plays a movie.

The movie file format emulates big-screen movies by including provisions for *posters* (i.e., still frames that represent the movie for printing) and *previews* (i.e., short clips that represent the movie when previewing). Because a movie file contains references to only its media data, it's small enough to put onto the *scrap*, which is the data container that the Mac Clipboard and Scrapbook use.

Apple has extended the PICT file format to allow for compression and previewing. Users can compress a still image using any compression scheme registered with the Component Manager and decompress a still image

**An inside look at
Apple's QuickTime
cross-platform
multimedia standard**

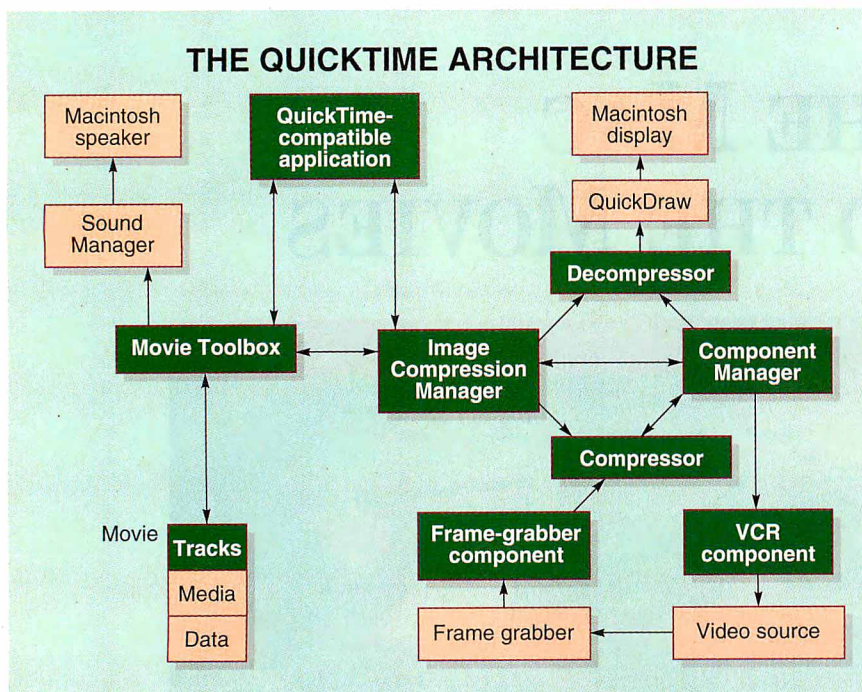


Figure 1: QuickTime applications interact with the Image Compression Manager, which shields the application from compression details, and the Movie Toolbox, which controls access to movie data. The ICM interacts with the Component Manager, compressor, and decompressor. In this figure, QuickTime elements appear in green.

using any existing, unmodified application as long as the QuickTime extension is installed. Using previews, applications can save a small 4- to 5-KB thumbnail image along with the actual image so that users can quickly browse through image libraries.

QuickTime provides a basic set of software compression/decompression schemes for still images, animation, and video. By standardizing the way in which programs compress images and movies, QuickTime makes it possible to move them easily between documents. This allows users to view thumbnails of images, preview a movie by snapping through images, and convert to PICT-file format on the fly. QuickTime 1.5, introduced last fall, supports Kodak's Photo CD standard. Thus, you can use Photo CD with any application that handles PICT files.

Apple specifies human-interface guidelines to provide consistency among the ways in which applications handle dynamic media. For example, the movie controller is a system software component that provides a consistent way of controlling movies: turning sound on and off, playing or stopping a movie, getting an indication of where in the movie you are, interactively moving around the movie, and cutting, copying, and pasting movie segments.

Movies, Tracks, and Media

Time is a fundamental concept in QuickTime movies. Every movie has a time scale, a time base, and a time-coordinate system. The time scale defines the unit of measure and the movie's duration. The time base is the current value of time along with a vector that defines the direction (forward or backward) and velocity of time (the current value of time is meaningless until the time scale is specified). The time-base value is extracted from the time-coordinate system, which essentially comprises the x,y axis on which the time-base vector is plotted.

Each track defines a separate set of data that can be interpreted within the movie's time-coordinate system. All tracks begin at the start of the movie, but not all of them contain data initially. Even those that do contain data won't play unless they are activated (see figure 2). QuickTime movies may have one or more tracks active simultaneously.

When you're editing a movie file, you define a segment by specifying a start time and a duration. Two elements define a movie's display characteristics: the movie source clipping region, which defines the portion of the source image that's visible, and the 3-by-3 transformation matrix, which determines how the image will be

rotated and scaled. The Movie Toolbox uses these elements to determine spatial characteristics, and it provides routines that let you work with movie or track characteristics, such as the volume setting and playback rate. The Movie Toolbox also lets each application store its own user data along with a movie.

A track is a private data structure with its own control information. Each track represents a single stream of data and refers to a single medium, or file, that contains movie data. A track contains a list of references, called an *edit list*, that defines the portions of the medium used. Consequently, a track can play the media data in any order, for any number of repetitions. Each entry in the edit list includes the starting time and duration of a track segment, along with the playback rate for that segment. The actual data may reside on a CD-ROM disc, a hard disk, videotape, or other medium.

A movie can contain more than one track of a given type. This is handy if you want to create a movie with sound tracks in different languages. You manage these tracks by assigning them to alternate groups and making one active at a time.

A QuickTime track's display characteristics are specified by the image size, a transformation matrix, and a clipping region. Each track also has a volume setting for sound.

The medium contains a track's data and information that identifies its language and quality. Each storage medium has its own time scale and duration, so any time values that relate to a given medium must be defined within the medium's parameters. A medium uses the time base of the movie that is using the medium's data, and the tracks map data from the medium's time system to the movie's time system. Each supported data type has a media handler that provides random access to the data and plays segments at rates that the movie specifies.

QuickTime movie tracks do not ordinarily contain movie data, but you can use the Movie Toolbox to create movie files that store the movie and all related data in the Mac data fork. This is useful for sharing QuickTime movies with computers that support QuickTime but don't support multifork files. QuickTime support is quickly moving beyond the Mac: Apple developed a QuickTime player for Windows, and Silicon Graphics has added QuickTime support to its applications.

The Movie Toolbox

At the heart of QuickTime is the Movie Toolbox. It includes scores of high-level routines that let you load, play, create, edit,

and store objects that contain time-based data.

The Movie Toolbox routines provide basic operations for opening and playing movies, as well as more complex routines for creating and manipulating the data that make up a movie's media types (i.e., sound, video, graphics, or animation). You initialize the Movie Toolbox by calling the `EnterMovies` routine. Similarly, the `ExitMovies` routine cleans up after your application is finished.

Before an application can work with a movie, it must load the movie and then create a new movie file in which to work. The `OpenMovieFile` routine opens a movie file; `NewMovieFromFile` loads a movie. When you play a movie, the Movie Toolbox processes the movie's data based on its time-coordinate system. If the movie contains video data, the Movie Toolbox displays the resulting images in the display window you specify. If the movie contains audio data, the Movie Toolbox plays the sound track at a volume level that you set.

The ICM

Uncompressed image data requires a large amount of storage space. At 30 frames per second, a 10-second movie containing 640-by 480-pixel frames with 8-bit color requires nearly 100 MB of disk space. Consequently, minimizing the storage requirements (and network and backplane bandwidth requirements) for image data is an important consideration for any application that works with images or sequences of images.

QuickTime's ICM provides applications with image compression and decompression services that are device- and algorithm-independent. Two points about the ICM are worth noting: Its architecture is open and handles many different kinds of algorithms, and it can read and perform compression schemes on the fly. The ICM also manages many display details, such as clipping, scaling, crossing screens, and fast dithering. In this way, the ICM enables all QuickTime-compatible software to use a common application interface for compression and decompression operations on images and sequences of images, and it allows an application to use images created with a different application.

The ICM invokes *compressor components*, code resources managed by the Component Manager that perform actual compression services (see figure 3). Applications communicate either directly with the ICM or indirectly via the Movie Toolbox, which passes requests to the Component Manager. The ICM does not maintain time information for an image

sequence—the Movie Toolbox handles all timing considerations—but it does maintain the order and content of the images.

The compression algorithm used affects the compression ratio and speed, symmetry, and image quality (e.g., loss characteristics). Different applications make different compression trade-offs. QuickTime ships with three algorithms. The photo compressor implements the JPEG (Joint Photographic Experts Group) algorithm, which QuickTime uses for PICT images. The video compressor uses an Apple-designed algorithm that permits fast decompression times while maintaining reasonably good picture quality. The video compressor allows interactive display of 24-bit images; processes input video images at 8-bit, 16-bit, and 24-bit color depths; and supports both spatial and temporal compression. The animation compressor is based on an algorithm optimized for animation and computer-generated video data.

The ICM also lets you obtain information about compressed images or about the facilities available for image compression, select a specific compressor, and determine how much memory to allocate to receive a decompressed image. You can even display a compressed PICT file without performing any special processing. When installed on a system, the ICM creates a new `StdPix GrafProc` procedure, which handles all requests to display pictures. Whenever an application issues

the standard `DrawPicture` function to display a picture that contains compressed image data, the `StdPix` procedure decompresses the image by invoking the ICM and delivers the decompressed image to the application.

The ICM uses PICT op codes to store the compressed picture's image description (i.e., its compression format and characteristics of the compressed image data), image data, transfer mode (`srcCopy`, `ditherCopy`, and so on), the accuracy with which the image should be decompressed, the matte pixel map, the mask region, the mapping matrix, and the source rectangle of the image. Masks and mattes control which pixels in the source image are drawn to the destination. Mattes provide a mechanism for mixing two images. Because the ICM stores the mask and matte images separately, you can apply different masks or mattes during decompression.

A QuickTime application might give the user the option to specify a compression algorithm that's based on performance characteristics such as size, speed, and accuracy. The ICM allows the application to choose the compressor component that meets the user's criteria. Many ICM functions accept special component identifiers that select the fastest or most accurate compression algorithm or the algorithm that produces the smallest compressed image from among those that are installed on a given system.

continued

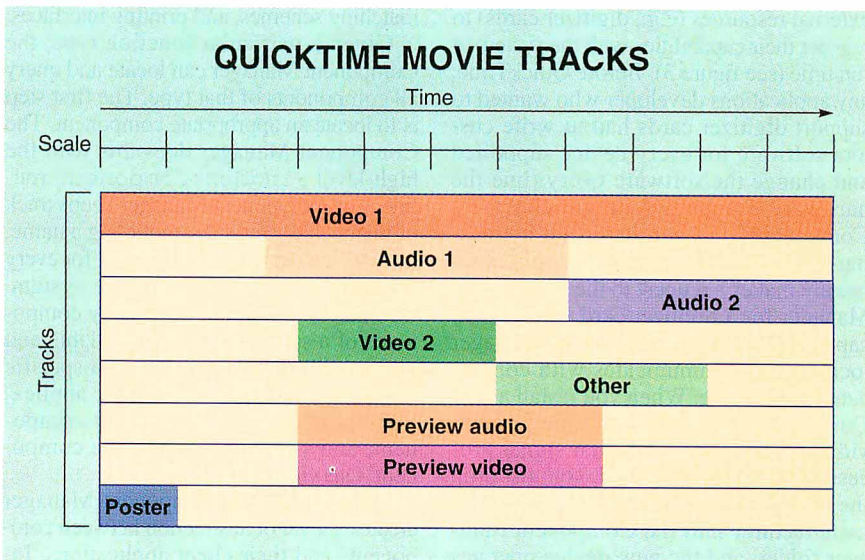


Figure 2: A QuickTime movie consists of multiple tracks that reference different data types on various media. Shown are five movie tracks, plus two preview tracks and a poster track. All tracks begin at the start of the movie, although the data does not always start at the beginning of a track. A track can end at any time, and QuickTime plays only those tracks that are active. Multiple tracks can be active at the same time.

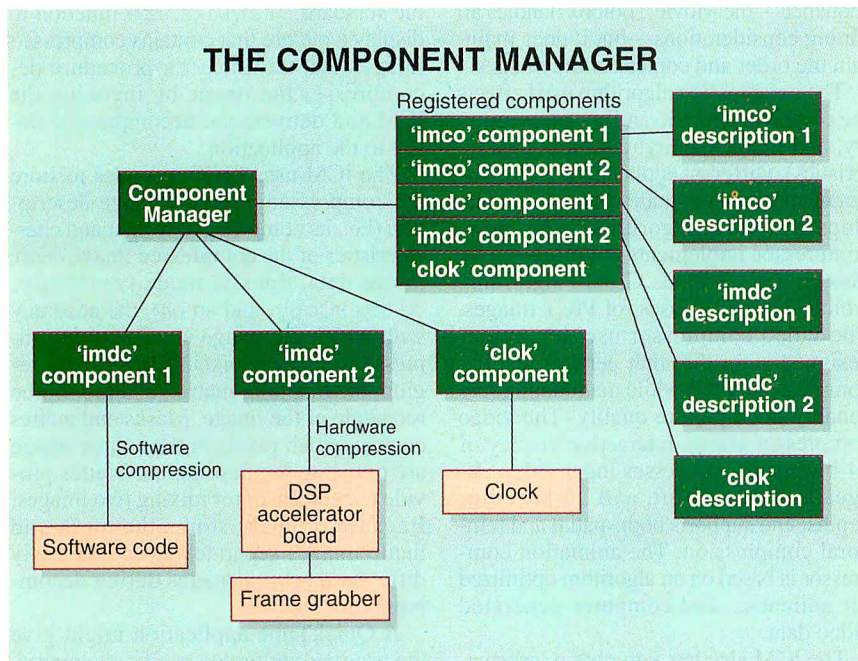


Figure 3: The Component Manager functions as a database that classifies objects by function and provides run-time binding to functional objects using the standard Toolbox routines. It allows applications to find predefined classes of software and objects and registers hardware resources. Here, 'imdc' represents the image decompression manager, 'imco' represents the compression manager, and 'clock' represents the system clock.

The Component Manager

The Component Manager allows applications to find and use predefined classes of software objects at run time, and it enables external resources (e.g., digitizer cards) to register their capabilities with the system at run time (see figure 3). Before QuickTime, any applications developer who wanted to support digitizer cards had to write custom software for every device supported and change the software every time the hardware changed. With QuickTime's Component Manager, hardware is transparent to applications. The application merely makes a request to the Component Manager for a digitizer card with certain capabilities, and the Component Manager locates and communicates with components of that type. When you install a new QuickTime device, be it a frame grabber, video board, or DSP (digital signal processor) compression board, you just drop the QuickTime driver provided by the manufacturer into the Component Manager folder, and the new device operates transparently.

The Component Manager uses standard Toolbox routines to provide a database service that classifies software and hardware objects by function and allows applications to bind with functional objects at run time. It is designed to handle any kind

of hardware or software module. Future modules that will be brought in via the Component Manager might include OCR (optical character recognition), color-matching schemes, and printing interfaces.

Given a particular function type, the Component Manager can locate and query all components of that type. The first step is to locate an appropriate component. The Component Manager does this with the high-level `FindNextComponent` routine. The Component Manager keeps track of many characteristics, including a name, an icon, and an information string for every component registered with the system. You can also find out how many components of a specific type are available and obtain additional details about a specific component's capabilities. Your application opens a connection to that component, and you can then use the component's services.

In this way, the Component Manager creates a level of abstraction between components and their client applications. Instead of implementing support for a particular data format, protocol, or model of a device, you can use a standard interface through which your application communicates with all components of a given type and use the Component Manager to locate and communicate with components

of that type. For example, components of type 'imdc' provide image-decompression services. All the components of type 'imdc' share a common application interface, but each image-compression component may support a unique compression technique or take advantage of a special hardware implementation. Algorithm- or hardware-specific variations of the compression interface are implemented by each 'imdc' component.

The Sound Effect

QuickTime sends audio information to the Sound Manager, which then sends the data to the hardware. This is the path a digital audio track takes to get from your hard disk to your Mac's speaker. The Sound Manager is a collection of routines that allow applications to create, edit, and play sounds directly from the Macintosh speaker or through the output jack of the computer—but it is not a part of QuickTime. Apple plans a new Sound Manager (which will still be separate from QuickTime) that will support high-quality 16-bit stereo sound hardware in addition to the Mac's internal speaker.

Individual components in QuickTime may support additions to the defined application interface, as long as they support the common routines. If you're using commercially available hardware, such as video I/O boards, sound boards, DSP accelerator boards, or dedicated image compressors, you will find that most manufacturers have chosen to implement an Apple-provided component on their hardware. However, you (or your card manufacturer) may elect to create your own component. You might do so in order to create an entirely new function, such as a new filter for a desktop publishing package; to add multimedia capability to a paint/drawing package; or to modify a component (e.g., adding MPEG [Moving Pictures Experts Group] audio compression to an existing MPEG video-compression component).

The Component Manager allows a single component to serve multiple client applications simultaneously. Each client has a unique connection path to the component, which maintains separate status information for each open connection.

QuickTime Components

QuickTime components are software objects, overseen by the Component Manager, that provide a defined set of services to client applications. QuickTime ships with dozens of components, including compressor components; movie controller components, which let applications play movies using a standard user interface;

We made this ad the same way some people still do calculations.

Aside from the quarter million or so people who already use Mathcad®, most engineers and scientists continue to do calculations by hand. Using calculators and

And print presentation quality documents complete with text, graphics and equations in real math notation.

Mathcad comes with more

to fully interactive formulas, diagrams and data tables directly from popular reference books. Work with them right

in the handbook itself. Or click and paste them for use in your Mathcad documents.

Plus optional

Applications Packs with modifiable templates are available for all major engineering and science fields.

So put down your pencil, pick up the phone and call now to get a free Mathcad Working Model and complete information. Or mail or fax the coupon below.

Once you get your hands on Mathcad, you'll never do math the same way again.

Call: 617-577-1017

Fax: 617-577-8829

1-800-MATHCAD



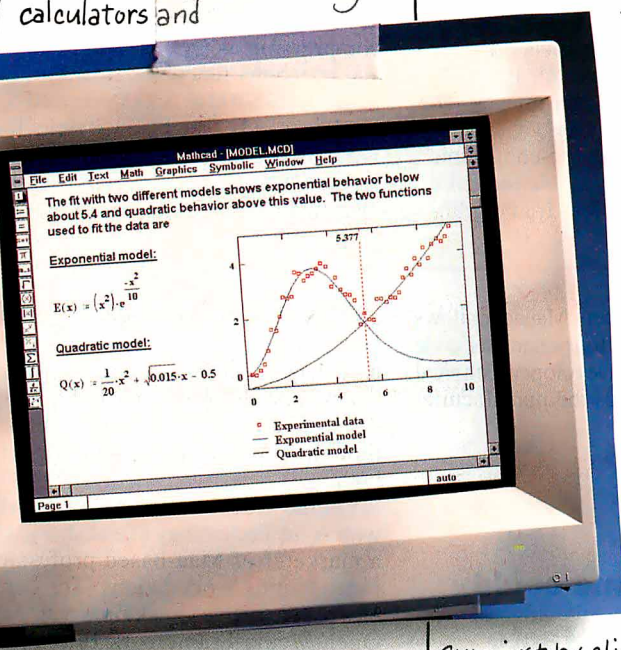
than 200 commonly used functions built-in, including exponentials, differentials, cubic splines, FFTs and more. Full symbolic capabilities are available with a menu pick, so you can evaluate any integral, Taylor series or infinite

sum just by clicking.

Optional Electronic Handbooks* give you instant access

scratch pads. Or jamming them into spreadsheets. Or pounding away at code on their keyboards.

Which is all quite unnecessary when you consider that Mathcad provides a faster, more natural, less error-prone alternative. Simply enter equations anywhere on the worksheet. Graph results in 2-D and 3-D. Change variables and instantly update answers. Add text to support your work.



FREE Mathcad Working Model.



The Mathcad Working Model includes a concise demonstration and a fully functioning version of the product. It's the best way to introduce yourself to the power and ease of Mathcad. B95

Name _____

Title _____

Company _____

Address _____

City _____

State _____

Zip _____

Country _____

Phone _____

SPECIFY:

- ☐ PC Windows™
☐ PC DOS ☐ UNIX®
☐ Macintosh®
☐ 3 1/2" ☐ 5 1/4" Diskette

MathSoft, Inc. 201 Broadway, Cambridge, MA 02139 USA • Phone: 1-800-628-4223 • 617-577-1017 • Fax: 617-577-8829

For information on Mathcad distributors outside of the U.S., contact MathSoft USA © 1992 MathSoft, Inc. TM and ® signify manufacturer's trademark or registered trademark respectively.
 *Electronic Handbooks require Mathcad 3.1.

Circle 96 on Inquiry Card.

QuickTime: Hardware-Hungry

Few computer applications are as demanding as digital video. A QuickTime movie strains the capabilities of processors, memory, disks, video and audio circuitry, and the various pathways that join them, even on a Mac Quadra. Full-motion, full-screen, full-color video requires a data transfer rate of approximately 27 MBps. One minute of such a video requires over 1.5 GB of storage. To reduce storage requirements, QuickTime implements on-the-fly compression and is algorithm independent. However, many users may want to budget for an accelerator board.

For most users, software-decompressed video is limited to small windows and low frame rates. QuickTime

1.5 can play 8-bit, 160- by 120-pixel color movies at 24 to 30 frames per second, or 320- by 240-pixel images at 12 to 15 fps on a Mac LC II. The speedy Quadra 950 can play back 8-bit, 640- by 480-pixel color movies with monophonic sound at 24 fps—just short of the 30 fps required for full-motion video.

Working in a small image area is acceptable for augmenting spreadsheets and word documents with video and animation clips, but it is not appropriate for video-intensive multimedia applications that require larger images and faster frame rates.

Fortunately, QuickTime-compatible hardware tools are available for audio and video compression, frame grab-

bing, and acceleration of the video display.

Many boards include both NTSC and PAL inputs and outputs. Accelerator boards use dedicated chips, such as JPEG (Joint Photographic Experts Group) accelerator chips; RISC chips; and DSP (digital signal processor) chips. DSP chips are well suited for QuickTime acceleration because they can handle a variety of QuickTime tasks, including both audio and video compression as well as fax, modem, and telephony functions. Board prices range from \$300 to \$3000, depending on your needs (see "New Tricks for Slow Macs" on page 198). However, regular QuickTime users will find the investment worthwhile.

movie grabber components, which are data-handling routines that accept video and sound input and write data to QuickTime movies; clock components, which handle timing sources and information; previewer components, which allow applications to display preview information; and video digitizer components. Custom components may also be provided by hardware vendors.

The Component Manager classifies each of these components according to its type, the level of service it provides, and its manufacturer. It uses a four-character designator to identify the type of service a component provides (e.g., all image compressor components have a component type value of `imco`). All components of a given type support a common application interface.

The Component Manager lets components identify the service level they provide by specifying a four-character component subtype value. An image compressor component uses the component subtype value to specify the compression algorithm that it supports. The component subtype value is meaningful only in the context of a given component type, and all components of a given type/subtype combination support a common application interface. However, components that share a type/subtype specification may support additional application routines that are not part of the basic interface.

Finally, the Component Manager allows components to have a four-character code (published by Apple Developer technical support) that identifies the manufacturer of the component.

QuickTime could become a de facto cross-platform standard.

Evolution in Progress

QuickTime is an evolving technology. Apple's initial focus has been on bringing video to the desktop. Because video is resource intensive, Apple is continuing to improve software-decompressed video data rates. Most users, however, will want extra hardware to handle the burden (see the text box "QuickTime: Hardware-Hungry" above).

QuickTime still doesn't handle all media data types. For example, it has no facility for dealing with SMPTE data tracks,

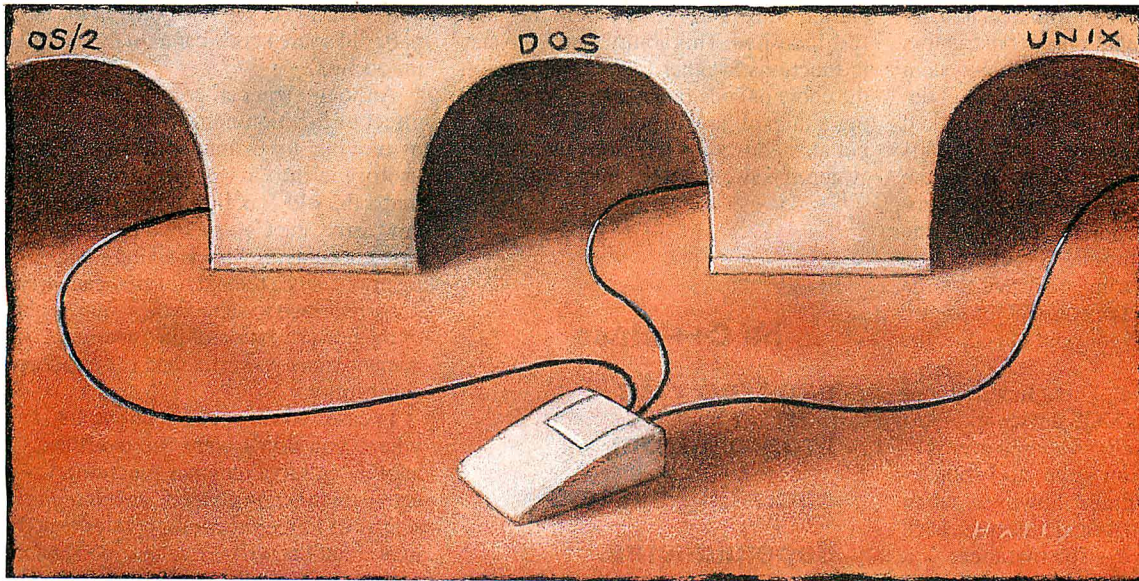
a standard in the video-editing world that QuickTime must support before it can be used in professional video-editing systems. QuickTime also isn't yet MIDI-aware and doesn't support CD audio systems, although Apple plans to add support for both.

On the video front, Apple is working with Avid Technology (Tewksbury, MA), a marketer of Mac-based professional video-editing workstations. The companies plan to merge QuickTime with Avid's Open Media Framework Interchange, Avid's file format for digital media compositions, along with the underlying data for both.

QuickTime's flexible architecture and hardware independence have earned respect from the Mac community. With support coming from Apple for Windows, and from third parties such as Silicon Graphics, QuickTime could take root as a de facto multiplatform multimedia standard for the 1990s. ■

Andrew W. Davis is an independent marketing consultant focusing on high-technology marketing communications and business development. His interests include data acquisition and image processing. Joe Burke is president and a founder of Spectral Innovations in Santa Clara, California. His interests include DSP. You can contact them on BIX c/o "editors."

HANDLING INPUT EVENTS USING C++



Since standard C has no support for mouse and enhanced keyboard events, programmers working in character mode must use whatever facilities the operating system provides. MS-DOS conveys mouse events to your program by way of interrupts. Under OS/2, you might use a device monitor. Unix options include treating `/dev/mouse` as a stream, using `_ioctl` calls, or exploiting signal events. In this article I'll present a C++ solution to the problem of handling mouse and keyboard events—a solution that's portable to DOS, OS/2, and Unix.

Event is a C++ class library I originally developed to handle input from the DOS keyboard and mouse. Over time, I've extended it to OS/2 and Unix as well. Much as with Windows or OS/2 Presentation Manager, Event allows the DOS programmer a single point of entry to monitor all standard messages. Thus, the class supports the development of event-driven programs. I'll demonstrate how to use the Event class, and I'll examine the key structures and class members that enable the class to do its job. I'll also discuss why C++ is uniquely suited to the development of portable, maintainable, reusable modules.

The Event Class

Since Event was originally built as a C++ wrapper around lower-level operating-system keyboard and mouse routines, it has been easy to port to other operating systems. By using the C++ ability to hide platform-specific func-

tions and data behind a class interface, I've been able to ensure that my code never used functions that would not be available to it on another operating system. The code I'll present here comes from the DOS implementation of Event.

When dealing with multiple sources of input messages, it's crucial to serialize those messages. For example, while typing in a string, a user might decide to press a function key instead, or to click on a mouse button. The Event class takes a two-pronged approach to handling this problem. I've overloaded its central method, `GetMessage`, to support two modes of message retrieval. One fetches input events of all types: characters, function keys, and mouse events. The other fetches whole strings and preserves noncharacter events separately. To use the class, a program calls `GetMessage`, which returns results in a structure called `MSG`. Other member functions exported by the Event class enable the program to get and set the mouse and cursor locations.

There's no need to initialize Event's data structures in order to use it, or to clean them up when you're finished. Nor need you worry about device (e.g., mouse) setup. That's typical of C++, which provides class *constructors* and *destructors* for these purposes. Constructors and destructors can handle setup and shutdown chores required by the class or the operating system and make

The Event class manages mouse and keyboard input for DOS, OS/2, and Unix

these issues transparent to the programmer. This transparent handling of device and class initialization ensures that by the time a program calls any members of the Event class, the method is primed and ready to do its job. In C++, class constructors and destructors carry the name of the class in which they are defined. As you can see in listing 1, the destructor carries a tilde in front of its name.

Constructive Coding

Because of the freedom from data and device initialization that class constructors and destructors provide, operating-system peculiarities used to control odd input devices (e.g., a mouse) can be safely tucked away inside class members. In DOS, this means that the command to turn on the mouse can be placed in the class constructor, while the chore of turning off the mouse is placed in the class destructor (see listing 2). Just declaring an instance of the Event class causes the constructor to run. When that instance goes out of scope, the destructor runs.

At its lowest level, Event merely loops through the various DOS device-monitoring interrupts, checking for input events—characters, function keys, and mouse-clicks. There are times, however, when you want more than a single message back from the keyboard—for instance, you might not want Event to return to you until it has read a string of a certain size. To deal with this requirement in standard C, you would quite naturally write another function to provide this new feature. The same is true in C++, but you get to reuse (*overload*) the function name. In the case of Event, I declared a primitive GetMessage function

```
DOSMSG
```

```
*GetMessage(char *, int);
```

and an alternative, string-building GetMessage function

```
DOSMSG *GetMessage(BOOL);
```

When you call `Event::GetMessage(...)`, the compiler can determine which version to use only by inspecting the parameters specified in the call. Since the compiler can easily distinguish `Event::GetMessage(BOOL)` from `Event::GetMessage(char *, int)`, there's no problem overloading the function.

Note that class constructors and destructors are always placed in the *public* portion of the class definition. If the prototypes for these two class members were placed in the *private* portion of the class instead, not even the C++ class initializa-

tion code would be able to call them. As their names imply, public members of a function or structure can be accessed by anyone able to create an instance of the class. Private and protected class members, however, can be accessed only by *friend* functions or other class members.

In standard C, you can get much of the effect of the C++ private or public statement by defining functions as *static* in separately compiled files. However, in C++, the class permits these functions and other class members to reside within the same file, if desired. This ability to refer to static functions in other files not only eases the chore of code maintenance by providing a map of how the class is to be used, but also allows for functions to be easily swapped between public and private views.

The C++ class can free your program from operating-system dependencies.

Unlike with static functions in C, when you move individual functions between visibility scopes in C++ you need only move the prototypes among the various sections of the class definition: private, protected, and public. You needn't change the functions themselves, which may reside physically in other files.

Having seen the advantage of function-name overloading and additional class-member scope classifications, you can see how the C++ class can free your program from operating-system dependencies. Strange and cryptic device-level interfaces can be hidden in the private portions of a class, initialized quietly by class constructors, and exported to the rest of the world through a public class member. The application programmer need only know which public class members are exported and how to use them. The ability to rigidly define how a programmer is to use your code is a critical part of providing yourself with a portable interface into other environments.

Certainly the ability to overload names and hide class members has the effect of

making a program more portable. However, when individual function names can so easily be overloaded, you can also see how C++ programs can be easier to develop and maintain. When a C++ function is modified, old programs can still keep their original entry points. If newer functions can differentiate themselves from older versions by at least one parameter (admittedly sometimes tricky), then obsolete functions don't have to be replaced—just overloaded and modified to call the newer version of the function. For the most part, old source code can remain virtually untouched.

Although you can get the approximate effect of function-name overloading in C by moving, for example, the old function prototype into a `#define` macro that maps the old function name over to the new name, the C++ method just described better documents what is taking place. Furthermore, since the old function can be entirely rewritten to support the requirements of the newer version of the function, C++ is much more powerful than simple macro substitution.

In cases where speed is important (i.e., where you don't want the overhead of another call to a member function), C++ provides the new concept of *inline functions*. An inline function operates exactly like a multiline `#define` macro (a feature not all C compilers support), substituting its entire function body wherever the inline function is called. In the struggle between space and speed, inline functions always save you the overhead of a function call at the expense of final execution-code size. Weigh the costs, and use these functions where appropriate.

The Event class has one inline function, `Event._mouse` (see listing 1). It's a private member function declared *inline* to avoid incurring the overhead of an additional call to the mouse-interface member function. I did this to speed up the call to the mouse interface, which is written in assembly language. (Note that the inline keyword in C++ is only a suggestion to the compiler.) Since the amount of assembly language in `Event._mouse` is small, the cost of inlining it is minimal.

Dealing with Data

With the overloaded GetMessage function, you saw how the parameters of the function call dictate which call you use, rather than the other way around. You might even say that overloading can make your programs data-driven, in a narrow sense. Note that C++ supports variable numbers of arguments to functions and even permits you to assign default values to those arguments if you need to.

continued

Listing 1: The Event class.

```
class Event {
public:
    DOSMSG DosMsg;
    // Class overhead and management;
    Event(); // Class constructor
    ~Event(); // Class destructor
    // Mouse-specific functions;
    BOOL HasMouse();
    POINT WhereMouseXY();
    BOOL SetMouseXY(int, int);
    // Keyboard-specific functions;
    int WhereX();
    int WhereY();
    POINT WhereXY();
    BOOL GotoXY(int, int);
    // Message retrieval;
    DOSMSG *GetMessage(char *, int);
    DOSMSG *GetMessage(BOOL);
    // Miscellaneous functions;
    void BellAlert(BOOL);
private:
    int C1X; // Keyboard cursor (cursor #1)
    int C1Y; // ibid.
    int C2X; // Mouse cursor (cursor #2)
    int C2Y; // ibid.
    int BUTTON; // 'L', 'R', NULL code
    int CTRLKEY; // Second value of scan code
    int bx, cx, dx; // Used for register calls
    BOOL bMouseOn; // TRUE = mouse installed
    BOOL bBellOn; // BEEP on error
    int GetEvent();
    // inline 4speed;
    int _mouse(int, int *, int *, int *);
    int MouseStatus();
    // Return FALSE (0) if no mouse
    BOOL MouseReset();
    // Only used for graphics mode
    void install_cursor_image(void);
};
```

Listing 2: Event's constructor and destructor.

```
Event::Event() {
    CTRLKEY = NULL;
    bBellOn = TRUE;
    // Return TRUE if mouse installed
    bMouseOn = MouseReset();
    if(bMouseOn == TRUE) {
        bx = cx = dx = 0;
        // Turn the mouse on
        _mouse(MOUSE_ON, &bx, &cx, &dx);
        // Set C2X, C2Y, and BUTTON
        MouseStatus();
    }
    // init keyboard stuff
    WhereXY();
    _setcursortype(_NOCURSOR); } //Event()
```

```
Event::~~Event() {
    if(bMouseOn == TRUE) {
        // Turn the mouse off
        bx = cx = dx = 0;
        _mouse(MOUSE_OFF, &bx, &cx, &dx);
    } else {
        // Destruct keyboard stuff
        // (not needed on DOS)
    }
    _setcursortype(_NORMALCURSOR); } //~Event()
```

Listing 3: Checking for Windows enhanced mode.

```
; *****
; Check for windows 3.0, 2.0
; AL = 1 if found, else AL = 0
; *****
is_win30 proc near
    mov ax,1600h ;test for enhanced mode
    int 2Fh
    or al,al ;extended check, AL==00h
    jz rstest
    cmp al,80h ;extended check, AL==80h
    je rstest
found_it:
    mov al,1; ;set AL
    ret ;return found
rstest:
    mov ax,4680h ;see real or standard?
    int 2Fh
    or ax,ax ;if AX==0
    jz found_it ;then we got it
    ; else
    xor al,al ;reset AL
    ret ;return not found
is_win30 endp

; *****
; Check for Windows 3.1
; CX = 3 enhanced, CX = 2 standard mode
; *****
is_win31 proc near
    mov ax,160ah ;windows there?
    int 2fh
    ret
is_win31 endp

; *****
; Give up time slice to Windows VM
; *****
to_win31 proc near
    mov ax,352fh ;get DOS vector
    int 21h
    move ax, es
    or ax, bx ;Is it there?
    jz no_need ;nope...
    mov ax, 1680h ;back to windows
    int 2fh ;give it up
no_need:
    ret
to_win31 endp
```


A simple, single data structure lies at the heart of the Event class. In the DOS implementation, I've named that structure DOSMSG. Although the data structure can differ from platform to platform, that wasn't required for the Event class: The structure was entirely adequate for the way events are gathered in OS/2, Unix, and DOS. However, if you need to prevent other classes from accessing some portions of a structure, then C++ allows you to declare parts of a structure private or public in the same manner as you would for a class. The default scope for class members is private, however, whereas the default scope for data structures is public.

When a DOSMSG structure is detected, `Event::GetMessage(BOOL)` returns a pointer to a structure that identifies all the information generated by the message. For example, mouse messages contain both the point at which they were generated (in the standard PC coordinate system, where 0,0 refers to the upper left corner of a positive coordinate plain) and what event caused the message (e.g., left mouse button or function key). Keyboard messages, on the other hand, contain a keystroke identifier and the location at which the key was pressed.

The message structure is declared as follows:

```
typedef struct tagDOSMSG
{
    int Type; // (key, mouse, etc.)
    int Msg; // KEYS.H if key,
            // or mouse-message-id
    POINT pt; // location
} DOSMSG;
```

POINT is just a pair of integers. This structure is sufficient to convey all keyboard and mouse activity to programs on three operating systems. The `DOSMSG.Msg` value is a signed integer; however, those desiring better support for double-byte characters might want to change the type to unsigned.

Using the Event Class

Once a class has been defined, C++ allows you to use it directly or to derive a new class from it that inherits (but can redefine or extend) its functions and data. To subclass Event, you would use the following syntax:

```
class MyEvent:public Event{..};
```

This says, "Create a new class named MyEvent based on the public portion of the Event class." If you just want to use the class directly without any further mod-

ification, you need only declare an instance of it. You can do this either with the C++ new operator (close cousin to C's `malloc`), or on the stack with a declaration like

```
Event InstanceOfEvent;
```

which calls the class constructor `InstanceOfEvent.Event` without further intervention. In C++, class constructors can have arguments and, like other class members, can be overloaded. Aside from being called once when the class is created, class constructors cannot be called by nonmember functions. Class destructors, on the other hand, can be called by anyone at any time and typically are not overloaded.

Here's how you declare and then use an instance of the Event class:

```
DOSMSG *pMsg;
Event InstanceOfEvent;
// Constructors are called
pMsg =
    InstanceOfEvent.GetMessage
        (BOOL);
```

This call to the overloaded function `GetMessage` in class Event will return the proper result: a pointer to a message structure.

When I first learned C++, I was intrigued by the ability to apply the C array operators `..`, `*`, and `->` to any class member. Unlike standard C, C++ allows pointers to classes, data, and functions within classes to be manipulated just like C arrays. If you wanted to pass a pointer to Event to another set of routines that would need to work with the class, you could use pointers in this way:

```
main()
{
    Event myEvent;
    ..
    ReadSomeData(&myEvent);
    // The "&" is required.
    ..
}

ReadSomeData(Event *pEvent)
// Could also be a void *!
{
    MSG *pMsg;
    ..
    pMsg =
        pEvent->GetMessage(&pMsg);
    ..
}
```

Once again, note that passing function pointers around is something you can han-

dle in standard C (perhaps with a few cleverly defined macros tossed in for good measure), but in C++ your code will be much more readable and easier to maintain over time.

You may have noticed that under DOS, Event spends much of its time polling devices. On preemptive operating systems like OS/2 and Unix, this polling activity is not much of a problem, since sharing the CPU is accomplished by the kernel, without your program's knowledge. Sharing the CPU under DOS, however, is a real issue.

Fortunately, running Windows in enhanced mode allows the 386 processor to run a DOS program in its own VM (virtual machine). This means that preemptive, nondeterministic multitasking can take place. Listing 3 shows how Event can detect that it's running in a Windows enhanced-mode VM and surrender time to Windows.

You might also want to execute another internal function while Event is checking for input. In such cases, Event could easily be modified to accept a pointer to a class (or to a single function) that would be called while Event was waiting for user activity. In this manner, the Event class itself could also provide your program with a platform-independent method for simple multitasking.

The C++ Advantage

I have focused on some of the practical aspects of using C++ in real-world programming situations, rather than on the more academic discussions of the advantages of using object-oriented programming techniques. The key advantage of using a language like C++ is not so much that it can do things that no other language can do, but that it can help you think in ways that you otherwise might not have considered.

Learning object-oriented design concepts and adapting them to the way you write your code today can also make porting and maintaining that code much easier in the future. However, there's no substitute for good design. If you start with a good one, C++ will help you maintain it over time. ■

Editor's note: *The complete listings described in this article are available electronically. See page 5 for details.*

Randall A. Nagy is a principal software development engineer for Informix in Lenexa, Kansas. He develops Windows, Unix, and OS/2 software. You can reach him on BIX clo "editors," or on the Internet at rnagy@informix.com.

A SMALL BROWSER WITH EVERYTHING

What features could I possibly offer in a DOS-based browse utility to make you switch from what you've got? Superfast access to large files might tempt you. The ability to spawn the file browser as a resizable text window from within a program should pique your interest. LAN awareness (i.e., file sharing) is a possibility; it's more a necessity than a luxury these days.

How about fast search operations using the Boyer-Moore algorithm? If you're still not convinced you'd want it, what about having the source code at your disposal for customization or incorporation into other programs? This month's selection is LIST, a file browser that incorporates all these features into a simple but quite handy utility.

Eyering the Browser

Some DOS-based file browsers operate slowly on large files or can't process them at all. To avoid this problem, I designed LIST to sometimes treat a file as a collection of lines of text and sometimes as a random-access set of blocks of characters.

LIST is a text-viewing utility with all the extras

This unusual mixture of line-oriented and random-access file I/O lets LIST move quickly through a file and still display the result in textual form. You can view the end of a 100-MB file about as quickly as you can view the next screenful.

If invoked with no command-line parameters, LIST asks for a filename. You can give LIST a single parameter—a file specification indicating the files you want to see—and the browser will operate in full-screen mode. You can use four additional parameters (i.e., the corner coordinates) to make LIST window itself on the screen.

You can run the executable file as a child process from almost any language (or shell to it from BASIC). From C, you could use the following to spawn LIST as a window in the middle of the screen, showing all the files in the current directory:

```
spawnl(P_WAIT, "list.exe", "*",
        "*", "4", "10", "22", "70", NULL);
```

In addition to using the cursor and other keypad keys for scrolling and paging, LIST has a toggle key for wrapping lines at the right side of the window and displaying a file in either hexadecimal or ASCII form. The bottom line of the browser's screen shows the file's size and the date and time the file was last updated. LIST restores the screen upon exit, so you don't lose track of what you were doing when you launched. Finally, you can shell to DOS from within the browser.

When you search for text in a file, you tell LIST whether the search should be case-sensitive. LIST uses the Boyer-Moore algorithm to move quickly through the file. (Having the source code to the search routines may be reason enough to get LIST.)

I used Borland's C compiler to develop LIST, taking advantage of Borland-specific library routines such as `clrscr()`, `clreol()`, `gotoxy()`, and `textattr()` to make life easier. You can use any version of Turbo C or Borland C++ to personalize LIST. ■

MAC/Tom Thompson

Pump Up the Finder

A common complaint against System 7.0 is that copying files takes longer. Because the System 7.0 Finder lets you run copy operations in the background or abort them with a mouse-click, it needs to take brief breaks during the copy process. These breaks allow CPU time for the Mac OS (to handle user events) or other applications.

SpeedyFinder7, a shareware Control Panel by Victor Tan, does some clever patching to speed file copies without sacrificing usability. SpeedyFinder7 allocates larger buffers (whose size is determined automatically or by the user) to read more data blocks and boost file-copy throughput. My timings show that the file-copy time for sending files through an Ethernet network was halved, while the time for copying files between hard drives was reduced by nearly a third. SpeedyFinder7 also eliminates the zoom rectangles that appear when an application launches, and it displays icons that indicate floppy disk type.

UNIX/Ben Smith

A Programming Perl

There are several ways to run a recursive-directory `grep` (i.e., search for a regular expression in all the text files in a directory tree). For example, you could issue the following command string: `find . -type f -l -exec egrep search-string {} \;`. You could also write a more flexible recursive `grep` in C, but that's hardly a trivial matter to accomplish.

If you choose Perl instead of C, however, the task gets a lot easier. Piet van Oostrum's excellent freeware, an `rgrep` Perl script, shows this simplicity. He's implemented `rgrep` in just 184 lines of Perl, and his program includes a help menu and a handy collection of options.

Van Oostrum's `rgrep` also does things that would be difficult or impossible with the `find` and `egrep` combination, like silently skipping binary files and scanning compressed files intelligently.

Editor's note: Software Corner highlights public domain, freeware, and shareware programs. The programs are available electronically. See "Program Listings" on page 5 for details. We solicit your contributions. We pay \$50 for any program we use. Write to: Software Corner, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

IF LOGIC ALONE DOESN'T CONVINCE YOU TO USE PROGRESS, THEN HOW ABOUT A LITTLE PEER PRESSURE?

1991 DATAPRO 1992 DATAPRO DBMS USER SURVEY

	PROGRESS SOFTWARE	SYBASE	INFORMIX	INGRES	FOCUS	ORACLE
ATTRIBUTES						
Reliability	9.3	8.7	8.9	8.1	7.7	7.9
Ease of Use	9.1	8.2	8.2	8.2	7.9	7.6
Ease of Install/Upgrade	8.9	8.0	8.8	7.8	8.1	6.3
Price/Perform Return	9.1	8.3	8.5	7.9	8.1	7.4
FUNCTIONALITY						
Flexibility	9.1	8.8	8.6	8.4	8.4	7.6
Interface Capabilities	8.9	8.9	8.4	8.1	8.7	7.4
Comprehensiveness	9.1	8.8	8.8	8.3	8.7	7.6
User Friendliness	8.9	7.7	8.3	8.1	7.5	7.0
OS Compatibility	9.6	8.4	8.9	9.0	8.8	7.5
PRODUCT SUPPORT						
Documentation	9.0	8.2	8.6	7.4	6.2	6.8
Vendor Training	8.7	7.9	8.0	7.9	7.6	6.7
Problem Response Time	8.8	7.5	7.2	6.8	6.4	6.2
Quality of Vendor Support	9.0	7.8	7.5	7.4	6.9	7.2
Frequency of Releases	8.5	7.5	6.7	6.9	7.7	7.2
Response to User Request	8.8	7.5	7.8	7.6	7.0	6.5
OVERALL SATISFACTION	9.3	8.7	8.5	8.3	8.0	7.6

Compiled from the latest Datapro reports on DBMS/Computer System Series Software available for each product listed (for Informix, see Informix/SQL). All results are those of actual users of the product as surveyed by Datapro.

1991 VARBUSINESS 1992 VARBUSINESS DBMS REPORT CARD

	PROGRESS SOFTWARE	BORLAND	INFORMIX	INGRES
PRODUCT FEATURES				
Ease of use	8.78	6.87	6.80	6.00
Memory requirement	7.25	6.30	6.14	5.11
Ease of programming	8.87	6.74	6.79	6.37
Ability to manipulate data	8.73	7.24	7.14	7.07
Sorting capabilities	8.59	7.24	7.21	7.58
Provision for software security	8.00	6.23	7.00	6.70
Report writing capabilities	7.64	6.54	6.59	6.50
Ease of use of interface	8.13	6.89	6.85	6.50
Software integration capabilities	8.09	6.92	7.20	6.15
Ease of data retrieval	8.89	7.26	7.65	7.04
Satisfaction with product profitability	7.98	6.61	6.79	5.19
Overall quality of product	8.87	6.97	7.35	6.71
PRODUCT FEATURES AVERAGE	8.32	6.82	6.96	6.41
SUPPORT FEATURES				
Provision for customer support	8.20	6.73	6.10	5.44
Charges for training time	6.91	5.79	5.56	4.71
Provision for technical support	7.57	6.14	6.00	5.15
Provision for marketing support	7.04	5.97	5.33	4.04
Documentation & product information	8.62	7.03	6.57	6.00
Frequency of updates & revisions	7.75	6.26	6.05	5.74
SUPPORT FEATURES AVERAGE	7.68	6.32	5.93	5.18
OVERALL AVERAGE	8.11	6.65	6.62	6.00

© 1992 VARBUSINESS Software Report Card reprinted with permission.

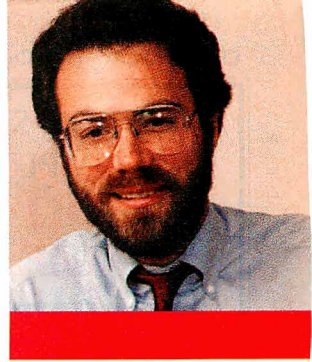
For the second consecutive year, PROGRESS resoundingly swept all 18 categories of the VARBUSINESS Report Card. And for the fourth year in a row, PROGRESS came out on top in the Datapro surveys. Once again, users rated PROGRESS superior to competitors on everything from strength of product to quality of service and support. Which is only logical, since PROGRESS is the one develop-

**PROGRESS
SOFTWARE**

ment system that gives you the flexibility to build and implement high performance applications independent of platforms and database systems. It even lets you deploy any application in both multi-user and client/server environments. But don't take our word for it. Listen to a source far more convincing. Your peers. For survey results or a test drive, call 1-800-4 PROGRESS.

THE APPLICATION DEVELOPER'S CHOICE.

PROGRESS applications are fully portable across the broadest spectrum of hardware platforms, operating systems, network protocols and user interfaces. So many, in fact, that we had to list them here in small type: AIX,™ CTOS, HP/UX,™ NOVELL® NLM, OS/1,™ OS/2,™ OS/400,™ UNIX® ULTRIX,™ VMS,™ XENIX,™ MICROSOFT® WINDOWS,™ X WINDOWS,™ DECnet,™ LAN MANAGER,™ NETBIOS,™ NOVELL® SPX/IPX, TCP/IP and SNA APPC LU 6.2. Also, PROGRESS lets you process information in other databases, including AS/400, C-ISAM,™ CT-ISAM,™ ORACLE, Rdb, and RMS.



MARK J.
MINASI

A NEW OS/2

There is no shortage of good news this month. By the time you read this, IBM should have released a new version of OS/2 (called 2.01 as this went to press) that's not only faster in the graphics department but also supports Windows 3.1 binaries. And developers will love the Professional Developer's Kit CD-ROM, which contains every piece of IBM software even vaguely related to OS/2.

ServicePak

Although the new version of OS/2 should be generally available by the time you read this, I've been working with IBM's ServicePak, which updates your current copy of OS/2 2.0. You can find the upgrade either in the IBMOS2 forum on CompuServe or on IBM's BBS at (404) 835-6600, or you can order the disks for \$24.95 by calling (800) 342-6672.

The ServicePak includes major improvements in the Micrografx 32-bit graphics engine, and support for Windows 3.1 binaries is on the way. Other improvements include ISO fonts and a Super VGA driver.

The graphics engine visibly improves the GUI speed on OS/2 2.0. For example, moving windows around on the Workplace Shell desktop is quicker. But it's not *exceptionally* faster, and it took me a few minutes to figure out why. Much of what makes graphics fast or slow is the graphical driver, and the basic VGA driver that I'm using on my OS/2 system (none of the generic ET4000 drivers seems to work on my system) still employs mainly 16-bit code. But having the internal manipulations run faster has provided a boost to system performance. Perhaps 32-bit VGA drivers for us local-bus users will appear one day or, as I imagine in my fondest dreams, perhaps S3 accelerator drivers.

There are still some annoying aspects to OS/2 that have not been addressed in the latest update. Like many OS/2 users, I boot OS/2 on some days and DOS on some

others, using the `boot/dos` or `boot/os2` command. Doing this, however, leads to a mildly problematic disk condition that CHKDSK refers to as "cross-linked extended attributes." There seems to be nothing one can do about this except to run CHKDSK from a floppy disk.

To this point in OS/2 history, this problem has been, in general, innocuous. The updated OS/2, however, seems a bit more sensitive to it than previous versions; I was unable to open my Drives folder until I booted from a floppy disk (no small task in the OS/2 world, as those who've done it know) and then used CHKDSK to eliminate the cross-linked extended attributes.

On the other hand, the Windows 3.1 support in this release is very good—bet-

ter, in fact, than I expected. The common dialog boxes have appeared for opening files and printer and font selection, and the Program Manager looks just like Windows 3.1's Program Manager.

The speed of video operations matches that of 3.1. There are even some video operations that are faster under OS/2 than under 3.1. OS/2 doesn't appear to incur much extra overhead. The bottom line: If you've been avoiding OS/2 solely because you're afraid that it won't run as quickly on your system as Windows will, you no longer have a reason not to run OS/2.

There is, however, an oddity about this release. Since April, IBM has released many patches that speed up the system or make it more stable. Perhaps the most famous is the file IBM1S506.ADD, which is a driver for hard disks that emulates the standard ST506 interface on ISA-bus machines. Downloading and adding IBM1S506.ADD speeds up disk access wonderfully under OS/2, and anyone who's not got this file yet should definitely get it. IBM advises you to download and apply the ST506 patch to the ServicePak-equipped OS/2. I'm not sure why IBM didn't just put the updated drivers and patches in the ServicePak, but I'm using the beta version; perhaps the final version won't have this problem.

IBM's ServicePak and a new CD-ROM bring a flood of OS/2 goodies

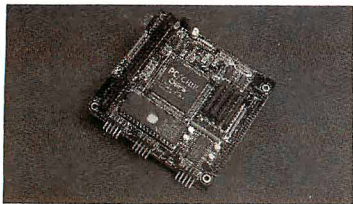


OS/2 Freebies

I got the Professional Developer's Kit CD-ROM disc in the mail the other day, and my first thought was, "Hallelujah!" Anyone who's installed OS/2 from floppy disks knows that disk flipping gets a bit old after you've reinstalled OS/2 for the third time. The idea that the whole bloody thing can be installed with just a few commands is the best news I've had since I started working with OS/2 five years ago.

After a bit of fiddling and some advice from some very helpful people at IBM, I got the thing running. It was truly great to finish an entire OS/2 installation in just a few minutes. I called the IBM folks who'd

"WORLD'S SMALLEST COMPUTER" CREDIT CARD SIZE PC



Now embed a 14MHz DOS compatible PC board in places where you thought it was impossible. It is now simple and inexpensive to build a

**Palmtop, Data Collection Unit,
Portable Communications
Device, PDA, Pen based hand
held unit, and more...**

ET3000

- 8086/80186 CPU
- Runs at 14MHz
- Fully compatible with DOS 3.0+.
- 1MB RAM, 256K SRAM, 512K EPROM (Optional larger size DRAM, SRAM available)
- Socket for PCMCIA memory card CGA and LCD support
- Keyboard, serial port RS-232 or RS485 support
- Low power consumption
- Optional peripheral board for FDD, IDE, controller, parallel, mouse port, analog to digital converter, sophisticated control functions.

Call for sample unit and complete development kit pricing.

**Phone (800) 662-8904
Int'l 1-508-975-4392
Fax (508) 689-8351**

*Custom hardware
and software
designs available.*

NASCOM COMPUTER CORP.
70 Flagship Drive, N. Andover, MA 01845

HANDS ON/BEYOND DOS

helped me to tell them how simple it turned out to be, and I asked how they planned to sell this CD-ROM version of OS/2.

"We're giving it away," they replied. I had to ask if I'd heard them correctly. I had, but there was a catch. This is all beta software, and IBM doesn't plan to release the final CD-ROM with all the software that's on this disc. It turns out that there's a lot more on there than just OS/2.

I hadn't looked at first. Since it's a developer's product, I figured I'd find a C compiler, a linker, some libraries, a debugger kernel, and the latest OS/2 beta version. But when I looked closer, my mouth dropped open. Besides the Service-Pak, it includes the latest C/2 compiler, the debugger kernel, LAN Server 3.0 (server code, as well as requesters for DOS and OS/2 workstations), NetWare and TCP/IP code for OS/2 2.0, the Developer's Toolkit (containing tons of goodies and sample code along with several books, including the "red books" IBM distributes with technical information on OS/2 and PS/2s), and several productivity tools.

There's more on this disc than buyers of the original OS/2 1.0 SDK (Software Development Kit) got for \$3000. The productivity tools consist of a nifty collection of Presentation Manager utilities, including a magnify tool that works like the zoom tool shipped with the Windows SDK, a program that creates a single-disk bootable floppy disk for OS/2, a simple drawing program, a program-execution timer, a world globe viewer that shows the part of the world currently in daylight and the part that's in darkness, a screen-capture program, and many others.

Visual Rexx

Of all the productivity tools on the disc, I've played mostly with a single item that appeared down on the bottom of the list: Visual Rexx, a command scripting language that's similar to the DOS batch language, a TSO `clist`, a CMS `exec`, or a Unix shell script.

I'm not the world's greatest fan of C programming. That's not an indictment of C programming or C programs; it's just one man's opinion. I'm not a professional programmer most of the time; I mainly consult, teach seminars, and write books. The only code I write these days is small utilities.

I loved Visual Basic for Windows for this reason: I could bang out a quickie utility in a few hours, even if I hadn't picked up Visual Basic in a few months. It's easy to learn, and it provides immediate gratification. I have grumbled many times about the fact that Microsoft has a Visual Basic for OS/2—the Visual Basic manual

is riddled with references that say things like "if you've got the OS/2 version of Visual Basic..."—but refuses to sell it.

What a pleasure it was to find Visual Rexx, which is much more powerful than the DOS batch language and has been supported in the OS/2 Standard Edition since version 1.3. But Rexx, like most procedural languages, has been slow to support GUIs directly. Visual Rexx solves this by simply adding a few functions to the basic Rexx repertoire that allow you to write Rexx routines that can put windows on the screen, draw objects, display text, and do all the things that you need done to build your own small Workplace Shell routine. In just a few lines of code, you can put up File/Open dialog boxes and build windows, listboxes, radio buttons—you name it.

Notice I said that Rexx is suitable for building *small* routines. There's no getting around the fact that Visual Rexx is interpreted, rather than compiled. But it's still pretty fast; a Visual Rexx routine I wrote to run under OS/2 2.0 outpaced a similar Visual Basic routine under Windows 3.1 on the same machine. If IBM decides to ship Visual Rexx with all copies of OS/2—even the nonbeta ones—then it could get a real leg up on Microsoft, which makes Visual Basic an extra add-on.

But to get back to the Professional Developer's Kit itself: What is its future, and how do you get a copy? The IBM folks I talked with said that they intend to update it with new products, but only beta products. The license agreement on all the software expires when the shrink-wrapped version appears; for example, the November release of LAN Server 3.0 made my license for the beta version evaporate. If you like the beta product, IBM wants you to *buy* the final product—not an unreasonable request when you consider that the beta product doesn't cost a dime.

At this writing (late fall 1992), IBM was offering this CD-ROM free to any member of the IBM DAP (Developer's Assistance Program). You can get a DAP application by calling (800) 342-6672, by leaving a message in the OS2DEV forum on CompuServe, or by visiting an IBM booth at any trade show where the DAP exhibits. Get it while you can: It's possible that IBM may decide to restrict this to "professional developers," whatever that means. ■

Mark J. Minasi is a technical educator and author. His Arlington, Virginia-based firm runs seminars on advanced PC operating systems. He has recently authored Inside OS/2 2.0 from New Riders and The Windows Problem Solver from Sybex. You can reach him on BIX as "mjminasi."

ASK BYTE

Type Contention

I upgraded from Windows 3.0 and Adobe Type Manager to Windows 3.1 a few months ago, and I'm having a problem using the TrueType screen fonts. I have a 486/33 with 16 MB of RAM and a Diamond Stealth video card with 1 MB of RAM. I'm running Windows at a resolution of 800 by 600 pixels.

The problem occurs when I'm typing a letter in Word for Windows and highlight words in boldface or italic. When I type the word *have* in boldface, every subsequent instance of the letters *h*, *a*, *v*, and *e* on that line appears as a mix of normal and boldface text. This behavior sometimes continues throughout the whole document. Occasionally, I'll go to the original line and delete a character, and Word acts like it updated the whole screen because that line corrects itself. Because of this, I find it a nuisance to work with TrueType fonts and have stuck with ATM.

Any idea what's wrong?

Eric Carlino
Glenview, IL

Your problem is a conflict between TrueType and ATM. Windows is confused because it doesn't know which screen font to display. Either use ATM (go into the Windows control panel and turn off the TrueType options) or disable ATM. Trying to use ATM and TrueType simultaneously will continue to cause problems.—Stan Wszola

Document Management for the Next Computer

I am interested in information on search-and-retrieval systems. This system must work with a scanner. I'd like to be able to fax from my machine and perform text retrieval on this data. I expect to manage 100 to 300 documents per day. About 75 people will have access to this data, possibly through a WAN (wide-area network). We would run this under Unix on Next computers and possibly Wyse terminals. Do you have any recommendations?

Cindy Castillo
Austin, TX

When we think of document management and Unix, we usually think of large, custom-developed systems that manage terabytes of information. A good example is the system at the U.S. Patent and Trademark office. Even though the databases may still be huge (e.g., the University of Toronto has a Kodak optical jukebox-driven, terabyte-size system), the user interface is much more to the scale and taste of the nontechnical user, and the workstations are from Next. You may see the result of that project appear as a commercial product shortly.

There's also a need for document management systems that are on the megabyte to gigabyte scale, like yours. There are a wide spectrum of products for personal computers. For the Next computer, you can look in Next's third-party products catalog. One product that fits your needs is Document Manager, which is available for \$995 from Boss Logic (1901 Landings Dr., Mountain View, CA



94043, (415) 903-7000; fax (415) 903-7009).

For the scanner system you want, you might try the OCR Servant products from HSD Microcomputer U.S. (1350 Pear Ave., Suite C, Mountain View, CA 94043, (800) 828-5522 or (415) 964-1400; fax (415) 964-1538). Evaluate them carefully, as BYTE has not tested these products.—Ben Smith

Addressing the Hardware

I'm an Amiga user, and I recently received an IBM PS/2 for controlling a robot I'm building. I can figure out how to build a card, but I have no idea how to address it from Borland C. Do I need to know which card slot it is in, or do I set the address on the card itself? Also, how do I address I/O space and not system space?

Jonas Klein
Northfield, MA

The system architecture of Intel-based machines like the IBM PS/2 is significantly different from that of Motorola-based machines like the Amiga. Amiga peripherals are memory-mapped into the system address space. Although interface cards may also be memory-mapped in the Intel architecture, the PS/2 has a separate I/O bus for communicating with peripherals.

Whether you decide to use the I/O bus or memory mapping to communicate with your peripheral card, you need to decode the addresses on the card itself. The Micro Channel interface adds a level of complication since, to meet specifications, Micro Channel boards should provide the ability to dynamically configure their address I/O ranges using a setup utility. However, it is possible to inform the Micro Channel bus that your address ranges are hard-coded and cannot be adjusted. This is probably suitable for an experimenter's hand-built card, although it's unsuitable for a commercial product.

Once you've solved the hardware problem, communicating with the card from a high-level language is straightforward. Borland C provides low-level calls called OUTPORT and INPORT for writing and reading words. Bytes can be written with OUTPORTB and INPORTB. Microsoft compilers provide similar capabilities. It is also rather simple to write the low-level interface code in assembly language and call that directly from your C applications.—Raymond GA Côté

TV vs. Computer

When I turn on my 386 computer and Super VGA monitor, they send noise through the house wiring. The TV reception through the antenna gets fuzzy, and the situation has become a bone of contention with my family. What's happening, and how do I fix it?

Andre Segui
Clermont, GA

You're going to get RF radiation from all parts of your computer—that's the nature of the beast. RF radiation

can sneak out of the equipment through the case openings, the case itself, cables, modem connections—you name it. Too much, and you start to obliterate radio and TV reception.

To minimize the problem, make sure that all your equipment is rated for FCC Class B certification (i.e., consumer-equipment certification) and that your machine is installed with all the manufacturer's case parts in place. Keep your cables as short as possible, and use good-quality wire for video, modems, and printers—shielded if possible. For the TV antenna, a good-quality 75-ohm shielded cable will filter out a lot more noise than a standard flat 300-ohm cable. Keep the computer as far from the TV as possible, and try to plug it into a different circuit if you can.

If all else fails, invite the rest of your family to use the computer, and get them hooked on it. If they appreciate having one in the house as much as you do, perhaps they'll stop complaining!—Howard Eglowstein

Not Ready Reading Drive A

I'm writing a DOS data acquisition program that writes data to the disk. I'd like to intercept any errors generated when the program tries to write to a floppy drive (i.e., A or B) that doesn't contain a floppy disk. I work mainly in FORTRAN, with some subroutines in assembly language.

I've tried using FORTRAN's INQUIRE command and several INT 21h variations, but I'm still getting "Not Ready Reading Drive A - Abort, Retry, Fail?" messages. Commercial packages handle this. How can I?

Bert van de Burgt
Tallahassee, FL

DOS handles disk errors through its critical error handler, INT 24. When an error occurs while trying to read to or write from a device, DOS sets the processor registers with error codes and other information and executes an INT 24. The default error handler gives you the "Abort, Retry, Fail?" prompt, but you're free to install your own handler. That's how the commercial packages do it.

Before accessing the disk, make sure your program takes control of INT 24. If something goes wrong, your program's handler will get control and can handle the error any way it wants to. Any good DOS programmer's reference will have the details of how INT 24 works.

—Howard Eglowstein

Macs on the Internet

I have noticed an increase in information on the Internet and how to reach it. The on-line services provide convenient E-mail, but is it possible to have a network connection on a Mac with a dial-up service?

I have used NCSA Telnet with FPT to transfer files to a Silicon Graphics Iris Indigo, but both machines were connected by the Ethernet. What software is needed to make a connection to an Internet provider? Can a Mac have an IP connection without running a form of Unix?

Bruce Hamilton
aol.com/bhamilton

I'll start with your last question first to put things in perspective. Yes, a Mac can have an IP connection without running Unix. You need MacTCP and a Control Panel that implements the TCP/IP stack on the Mac OS. You'll need the latest version of MacTCP (1.1.1) to operate with System 7.1. To obtain it, order the MacTCP 1.1.1 Developer's Kit from APDA, Apple Computer, P.O. Box 319, Buffalo, NY 14207, (716) 871-6555; fax (716) 871-6511. Ask for part number B0944LL/A, which sells for \$100.

Next, obtain an IP number from your network administrator. This address is required to configure MacTCP, and you need a unique one so that when your Mac operates on the network, it won't conflict with other computers' IP addresses. With MacTCP installed, you can connect to Unix workstations using TCP/IP over the Ethernet in two ways.

If your Mac is connected to the network with LocalTalk, you need a router (e.g., the Cayman Systems Gator-Box CS or Shiva's FastPath 5) to transfer the TCP/IP traffic between LocalTalk and the Ethernet. With this arrangement, you'll definitely need the network administrator to set up the IP number, plus any additional information the router might require to handle the address mapping between the two networks. If you've already cabled to the Ethernet, either through an Ethernet board or because you're lucky enough to own a Mac Quadra, you simply need to get an IP address.

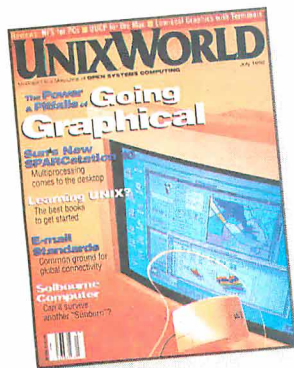
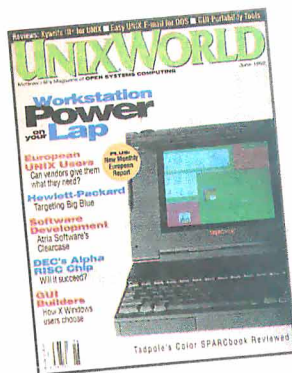
Now for your first question. You are familiar with NCSA Telnet, which requires MacTCP to provide the TCP/IP communications that are required. The latest version of Telnet (2.5) supports both serial and SLIP connections. The serial connection establishes a console window-style session with a remote Unix system. SLIP establishes a serial connection that resembles an actual Ethernet connection. You'll need a modem, the phone number of the host system's modem, and a log-in name and password.

To establish the serial connection, you check the serial/SLIP box in Telnet's Open Connection dialog box. In the window that appears, you type the phone number of a Unix workstation that operates as a terminal server. When the connection is made, you use the name and password to rlogin into the system. For SLIP, you'll need the phone number of the host system's modem and its IP number. Also, the host system has to be configured to recognize and handle a SLIP connection. For more information, consult the Telnet 2.5 documentation files, which are available on most on-line networks.

Why did I mention the Ethernet connection when you want to connect to a remote site? Because an Internet connection might be only as far away as your Unix wizard. At BYTE, I use MacTCP and Telnet 2.5 over the Ethernet to log into bytepb, a Unix workstation whose duty is to handle our Internet mail. This saves me the effort and expense of contacting a remote system. It's like dropping the mail off at your local post office, confident that people (or mechanisms) behind the scenes will make the appointed rounds.—Tom Thompson ■

The BYTE Lab welcomes your questions. Address correspondence to Ask BYTE, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. You can also send BIX mail c/o "editors."

We read every letter, but due to the volume of mail received, we cannot guarantee a response. We edit all letters for brevity.



Explore UNIXWorld...Risk Free!

Yes! Start my one-year (12 issues) subscription for only \$18.00. That's 50% off the newsstand price.

NAME (please print) _____ TITLE _____

COMPANY NAME _____

ADDRESS _____ ☐ HOME ☐ OFFICE

CITY _____ STATE _____ ZIP _____

☐ BILL ME AT \$18.00* ☐ PAYMENT ENCLOSED PLEASE CHARGE MY ☐ VISA ☐ MASTERCARD ☐ AMEX

CARD #: _____ EXPIRATION DATE _____ SIGNATURE _____

*U.S.A. ONLY. Canadian: 1 yr. \$24. Other Foreign: 1 yr. \$51 air delivery. All foreign orders must be prepaid in U.S. funds.

Please complete all questions to qualify for the rates shown above. Subscriptions at the above rates are limited to persons with active professional, functional and managerial responsibilities in UNIX or XENIX computing. Other subscriptions: \$36 a year in U.S., Canada: \$48, Other Foreign: \$102 air delivery.

CIRCLE ONE ONLY My company's primary business

- a. Mfg. of Comp./Comp. Equip.
- b. Other Manufacturing
- c. Systems Integrator/House
- d. Software Developer
- e. VAR, Dealer or Distributor
- f. Communications/Telephone
- g. Transportation/Utilities
- h. Mining or Construction
- i. Fin./Ins./Real Estate
- j. Wholesale or Retail Trade
- k. Consulting
- l. Government or Military
- m. School or University
- n. Other: _____
- o. Medical/Dental/Legal
- p. Research/Development

CIRCLE ONE ONLY My primary job function

- a. Corp. or Financial Mgmt.
- b. MIS/DP Mgmt.
- c. Office Mgmt./Administration
- d. Network Mgmt./Telecommunications
- e. Systems Integration
- f. Design or Dev. Engineering
- g. Prog./Software Development
- h. Research/Analysis
- i. Marketing or Sales
- j. Purchasing
- k. Mfg./Production
- l. Distribution
- m. Education/Teaching
- n. Consulting
- o. Government/Public Admin.
- p. Other: _____
- q. Technical Staff/Eng. Support

CIRCLE ONE ONLY The number of employees at all locations of my company

- a. Under 10
- b. 10 - 49
- c. 50 - 249
- d. 250 - 999
- e. 1,000 - 4,999
- f. 5,000 or more

CIRCLE ALL THAT APPLY I purchase/influence the purchase of the following:

- a. Mainframe Computers
- b. Minis/Superminis
- c. Micros/Supermicros
- d. Workstations
- e. Board-Level Products
- f. Terminals
- g. Printers
- h. Disk Drives
- i. Tape Drives
- j. Modems/Multiplexers
- k. LAN Equipment
- l. Software

ZB3B505

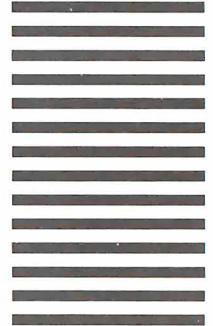
Save 50%

Your No-Risk Guarantee: I may cancel at any time and receive a refund for the balance of my subscription. Please allow 6-8 weeks for processing.

UNIX is a registered trademark of UNIX System Laboratories, Inc. UnixWorld is not affiliated with AT&T.



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES



BUSINESS REPLY MAIL

FIRST CLASS MAIL PERMIT #42 HIGHTSTOWN, NJ

POSTAGE WILL BE PAID BY ADDRESSEE

UNIXWORLD

SUBSCRIPTION SERVICES

P.O. BOX 570

HIGHTSTOWN, NJ 08520-9328



Up to Date. Down to Earth.



UNIX is changing the world of computers, the world of business – quite simply, changing the world. It's revolutionizing office automation. It's required for U.S. government computer contracts. It's the backbone of information strategies worldwide.

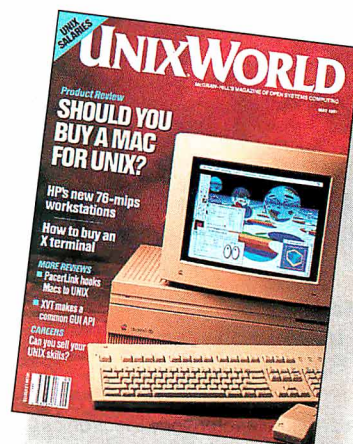
That's why you need **UNIXWORLD** – the magazine that keeps you up to date on the rapidly changing world of open systems computing. Each issue brings you the latest product trends and technical advances that can affect your business. The inside story on some of the biggest high-tech companies. Easy-to-understand programming tips and tutorials that can help your company use UNIX to its fullest. And unbiased hardware

and software reviews to help you invest wisely when you buy.

UNIXWORLD's in-depth features go beyond dry technical facts to show how the pieces fit together – to tell you what's important about the advances and strategies that are changing your world. And **UNIXWORLD** consistently offers the freshest, most down-to-earth writing that you'll find in any computer publication.

Subscribe today and receive the next 12 issues of **UNIXWORLD** for just \$18.00 – half the regular newsstand price. Save even more by ordering for two or three years. You can't lose – every subscription to **UNIXWORLD** comes with a no-risk guarantee*.

Subscribe now!
Call toll-free:
1-800-257-9402 ext. 29



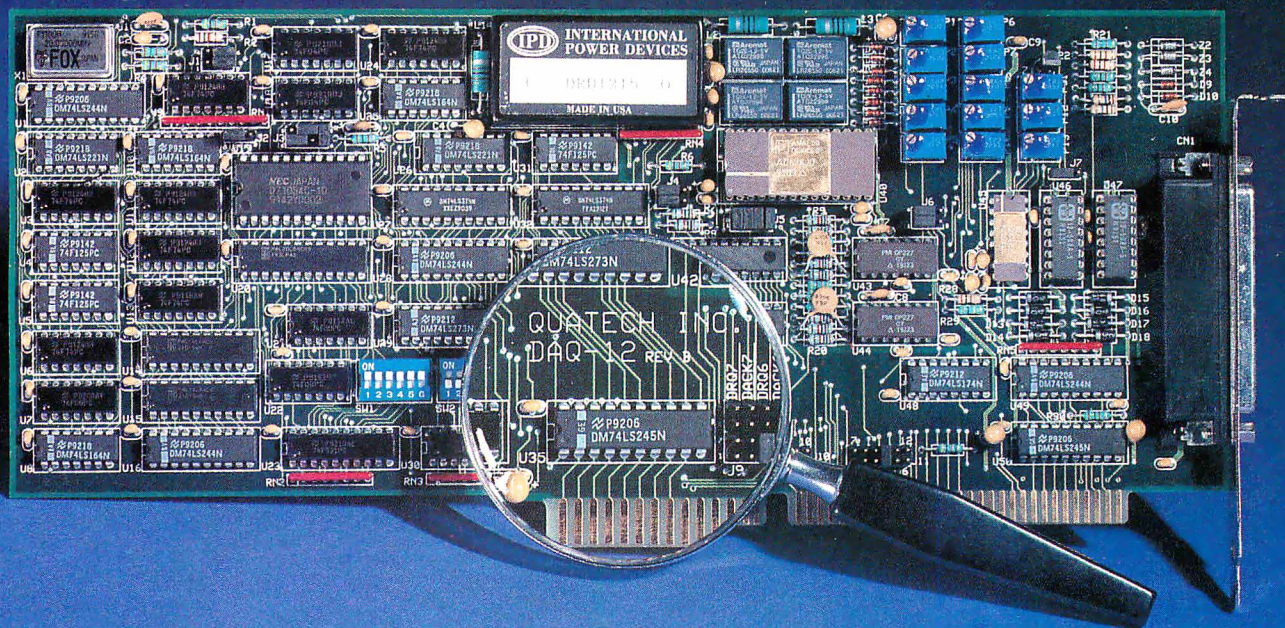
If you're into UNIX, you need

UNIXWORLD

McGraw-Hill's Magazine of **OPEN SYSTEMS COMPUTING.**

***UNIXWORLD's** no-risk guarantee: If not satisfied, cancel and receive a full refund for the balance of your subscription.
UNIX is a registered trademark of UNIX System Laboratories, Inc.

If your board doesn't say Quatech Inc., you may be missing something...



Ask a Quatech sales Engineer to show you the value of quality, service and support.

- Quatech manufactures a complete line of data acquisition, communication, and Micro Channel boards for the PC AT/XT, PS/2 and compatible computers.
- Quatech's user friendly software drivers enable our full featured adapters to support most popular operating systems.
- Quatech's adapters are backed by our free on-line technical support.



For a free catalog call: **800-553-1170**

International: Australia/Interworld Electronics 03-563-7066, Canada (Western)/Interworld VCR 604-984-4171 (Toronto office 416-513-7027), England/Diamond Point International 634-722-390, Finland/Lab Hitech OY 358-0-804-2522, France/Elexo 33-1-69302880, Germany/Jupiter Electronic Systems 06181/75041, Israel/RCM Ltd. 972-03-5447885, Italy/N.C.S. Computer Italia 0331/770-016, Netherlands/ACAL Auriema 040-816565, Korea/Sam Boo Enterprise Co. 82-2-538-4001, Spain SANTA Barbara SA 34-3-203-9916, Singapore Bliss Services Pte Ltd (65) 338-1300. IBM PC-XT, AT, PS/2 and MicroChannel are registered trademarks of IBM Corp.

QUATECH

662 Wolf Ledges Parkway
Akron, Ohio 44311 U.S.A.
216-434-3154



BUY IT THROUGH **BYTE**

Mail Order

The latest offerings from vendors supplying products of all leading manufacturers at extremely competitive prices.

244

Hardware/Software Showcase

This *categorized* four-color display section makes it easy to find Hardware and Software products from a wide variety of manufacturers and suppliers.

266

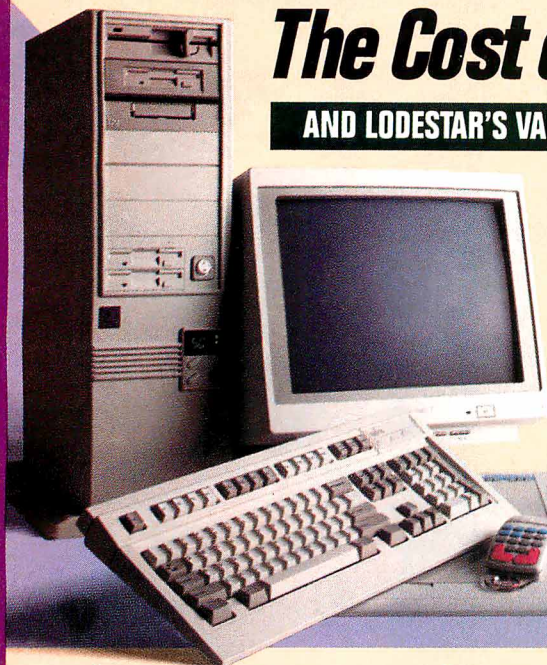
Buyer's Mart

From Accessories to Laptops to Word Processors, you can easily find the dealers you are looking for in this directory of products and services.

274

The Cost of 486 Power is Falling Fast.

AND LODESTAR'S VALUE KEEPS GOING UP:



CONSIDER THESE

EISA FEATURES: We've carefully designed a 32-bit processing solution that breaks through the ISA bottleneck while maintaining downward compatibility with a 16-bit Bus for a peak data transfer rate of 33 MB/sec. Six, true, fully blown EISA Bus Mastering slots plus two EISA slave slots so you can be assured your EISA mastering add-on cards will work for you (typical 8 slave slots won't).

LODESTAR's bus mastering, intelligent expansion cards with their own I/O processors operating in parallel with the main CPU, frees up your load on the CPU. Bus throughput is improved by implementing direct memory access (DMA) and bus masters.

Its speedy performance capability provides you with an ideal solution for a wide range of demanding applications, like CAD/CAM/CAE, formidable database management, image processing, artificial intelligence, desktop publishing and in the environments of network and multiuser systems.

NEW \$1349

486-SX Workstation

486-SX/20

- 4MB fast RAM expandable to 32MB
- 85MB 15ms IDE hard drive w/cache
- 1:1 interleave 2H/2F IDE controller
- 1.2MB 5.25" & 1.44MB 3.5" floppy drives
- 16-bit 1024x768 SVGA card w/1MB RAM
- 14" 1024x768 0.28mm dot pitch SVGA color monitor
- 2 serial, 1 parallel & 1 game port
- MS DOS 5.0 & MS Windows 3.1
- Enhanced 101-key keyboard
- High resolution serial mouse
- Mini-vertical case

486-SX/25 \$1389

NEW \$1639

486 ISA Dataquest

486/33

- 64K ultrafast write-back cache SRAM
- 4MB fast RAM expandable to 32MB
- 130MB 15ms IDE hard drive w/64K cache
- Teac 1.2MB 5.25" & 1.44MB 3.5" floppy drives
- 16-bit 1024x768 SVGA card w/1MB RAM
- 14" SVGA 1024 non-interlaced 0.28mm dot pitch color monitor. VESA 72Hz flicker-free display
- 2 serial, 1 parallel & 1 game port
- MS DOS 5.0 & MS Windows 3.1
- Enhanced 101-key keyboard
- High resolution serial mouse
- Desktop case

NEW \$2079

486LB WINstation

486-DX/33

- 2 32-bit Local Bus expansion slots for 32-bit power expandability
- 64K ultrafast write-back cache SRAM
- Built-in 487 math coprocessor & 8K cache in the CPU
- 4MB fast RAM expandable to 32MB
- 130MB 15ms IDE drive w/64K cache
- High throughput Super IDE Caching Controller. Reduces average disk seek time to 0.2ms
- Teac 1.2MB 5.25" & 1.44MB 3.5" drives
- 32-bit Local Bus S3 Graphics Engine w/1MB VRAM. Up to 1280x1024 resolution & 32,768 colors
- 14" 1024x768 non-interlaced 0.28mm dot pitch SVGA monitor. VESA 72Hz flicker-free display
- 2 serial, 1 parallel & 1 game port
- MS DOS 5.0, Windows 3.1 & mouse
- Enhanced 101-key keyboard
- Mid-vertical case

486-DX2/50 \$2219

486-DX/50 \$2319

486-DX2/66 \$CALL

NEW \$3329

486 EISA CADstation

486-DX/33

- 256K ultrafast write-back cache SRAM. Provides better hit-rate.
- Built-in 487 math coprocessor & 8K cache in CPU
- 8MB fast RAM
- 213MB 13ms IDE drive w/64K cache
- High throughput Super IDE Caching Controller. Reduces average disk seek time to 0.2ms
- Teac 1.2MB 5.25" & 1.44MB 3.5" drives
- 32-bit SVGA card w/1MB RAM. Up to 1280x1024 resolution & 65,536 colors
- 17" Award Winning Viewsonic 7 SVGA monitor. flat screen up to 1280 x 1024 resolution & 76Hz ultra high refresh rate
- 2 serial, 1 parallel & 1 game port
- MS DOS 5.0, Windows 3.1 & mouse
- Enhanced 101-key keyboard
- Desktop or mid-vertical case

486-DX2/50 \$3469

486-DX/50 \$3579

486-DX2/66 \$CALL

Some of our most astute customers are buying today, upgrading tomorrow.

To maximize the useful life of their systems, our customers depend on us. No need for them to unplug an obsolete system. They're using the power they need today and, with their LODESTAR StarFlex Series, they'll be upgrading simply, painlessly. LODESTAR's unique StarFlex CPU sockets are built right into the system. Upgradable all the way from 386DX to 486SX or 486DX, at any clock speed.

They keep coming to us because most other "upgradable" systems require purchase of a special CPU module board. This causes some performance loss due to speed adjustment. And they couldn't rely on those vendors being there when they needed to upgrade. Nor could they rely on sky-rocketing prices. So they've been calling LODESTAR.

Now Our Customers Are Getting It All—Value, Features and Price.

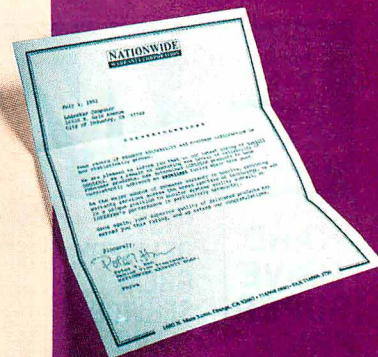


How thousands of our customers are **BUYING DIRECT**

When they buy from us, they're buying directly from the factory. So they get more value with each purchase, and are always assured their system is backed directly by the people who assembled it.

NOW

**THESE PRICES
GUARANTEED
THROUGH
MARCH 31, 1993**



**We Won Again.
And you enjoy the benefits.**

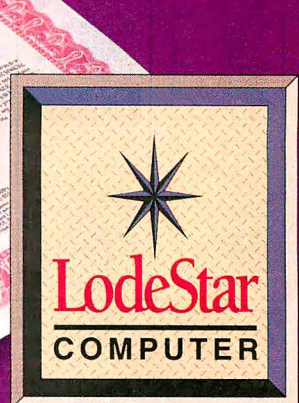
In their latest survey of **QUALITY CONTROL**, proven by this nationwide provider of warranty services, **LODESTAR** again has earned their rating **EXCELLENT**.

SHIPMENT WITHIN 48 HOURS

Every system is individually pretested and burned-in for 72 hours prior to shipment.

We have the right system for you. If it's not already configured, we'll customize it.

Systems can be upgraded to include optional cache, RAM, more hard disk capacity, larger monitor and a host of other enhancements.



"YOU MADE US A LEADER."

18539 East Gale Avenue
City of Industry, California 91748
Telephone: 1-818-810-3818
Tech Support: 1-800-875-7569
Fax: 1-818-810-5928
Open Hours:
Mon-Fri: 7am-7pm (PST)
Sat: 9am-4pm (PST)

NOW \$1099

386-SX Workstation

386-SX/25

- 2MB RAM expandable to 32MB
- 85MB IDE hard drive w/cache
- 1:1 interleave 2H/2F IDE controller
- 1 2MB 5.25" & 1.44MB 3.5" floppy drives
- 16-bit 1024x768 SVGA card w/1MB RAM
- 14" 1024x768 0.28mm dot pitch SVGA color monitor
- 2 serial, 1 parallel & 1 game port
- MS DOS 5.0 & MS Windows 3.1
- Enhanced 101-key keyboard
- High resolution serial mouse
- Mini-vertical case

386-SX/33 \$1139

NOW \$1359

386-DX Workstation

386-DX/25

- 4MB RAM expandable to 32MB
- 130MB 15ms IDE hard drive w/64K cache
- 1:1 interleave 2H/2F IDE controller
- 1 2MB 5.25" & 1.44MB 3.5" floppy drives
- 16-bit 1024x768 SVGA card w/1MB RAM
- 14" 1024x768 non-interlaced 0.28mm dot pitch SVGA monitor
- 2 serial, 1 parallel & 1 game port
- MS DOS 5.0 & MS Windows 3.1
- Enhanced 101-key keyboard
- High resolution serial mouse
- Desktop or mini-vertical case

386-DX/33 \$1399

386-DX/40 \$1439

NOW \$1459

StarFlex 3/486C

386-DX/25

- CPU upgradable to 386DX, 486SX, 486DX, 486DX2. Up to 66MHz
- 64K ultrafast write-back cache SRAM expandable to 256K
- 4MB fast RAM expandable to 32MB
- 130MB 15ms IDE drive w/64K cache
- 1 2MB 5.25" & 1.44MB 3.5" drives
- 1MB SVGA non-interlaced color card
- 14" 1024x768 non-interlaced 0.28mm dot pitch SVGA monitor. VESA 72Hz flicker-free display
- 2 serial, 1 parallel & 1 game port
- MS DOS 5.0, Windows 3.1 & mouse
- Enhanced 101-key keyboard
- Desktop or mini-vertical case

386-DX/33 \$1489

386-DX/40 \$1519

486-DX/33 \$1739

486-DX2/50 \$1939

486-DX/50 \$2049

486-DX 2/66 \$CALL

Your Assurance of Complete Satisfaction

OUR RISK-FREE GUARANTEE

Look for your comprehensive, written guarantee when you take delivery of any **LODESTAR** system. This industry-acclaimed, **FIVE WAY Personal Warranty** proves our willingness to stand behind everything you buy from **LODESTAR**.

CALL FOR YOUR FREE COPY; we'll fax or mail it immediately. Use the **LODESTAR FIVE-WAY GUARANTEE** as your shopping guide; compare and question the others before ordering.

1-800-875-3818

All specifications subject to change without notice. 2-Year Parts Warranty applies to advertised LodeStar systems only. Money Back Guarantee does not include shipping & handling, and all returns must be shipped pre-paid & in reasonable condition. Please call to confirm all warranty details. Photography is for illustration only. No surcharge on VISA, MasterCard & Discover. Purchase orders are accepted on approved credit. California orders add 8.25% sales tax. All product names, trademarks and registered trademarks are the property of their respective companies. © 1992 LodeStar Computer Corp.

Circle 180 on Inquiry Card.



GOVERNMENT, SCHOOL AND CORPORATE
ORDERS WELCOME. TO RECEIVE YOUR FREE COPY
OF OUR PRODUCT CATALOG, JUST CALL.

LIFETIME WARRANTY 100% GUARANTEED SUPER SAVING SURGE 1x9\$ CALL SIMMS 70 NS 4x9\$ CALL CALL FOR LATEST SIMM PRICES

HARD DRIVE DELIVERY, GREAT SERVICE AND LOW PRICES \$CALL

MATH CO-PROCESSORS

INTEL	CYRIX	ITT	
80387 5MHz INTEL	49.00	80387 5MHz ITT	59.00
80387 10MHz INTEL	59.00	80387 10MHz ITT	69.00
80387 20MHz INTEL	69.00	80387 20MHz ITT	79.00
80387 33MHz INTEL	79.00	80387 33MHz ITT	89.00
80387 40MHz INTEL	89.00	80387 40MHz ITT	99.00
80387 50MHz INTEL	99.00	80387 50MHz ITT	109.00
80387 60MHz INTEL	109.00	80387 60MHz ITT	119.00
80387 80MHz INTEL	119.00	80387 80MHz ITT	129.00
80387 100MHz INTEL	129.00	80387 100MHz ITT	139.00
80387 133MHz INTEL	139.00	80387 133MHz ITT	149.00
80387 166MHz INTEL	149.00	80387 166MHz ITT	159.00
80387 200MHz INTEL	159.00	80387 200MHz ITT	169.00
80387 266MHz INTEL	169.00	80387 266MHz ITT	179.00
80387 333MHz INTEL	179.00	80387 333MHz ITT	189.00
80387 400MHz INTEL	189.00	80387 400MHz ITT	199.00
80387 500MHz INTEL	199.00	80387 500MHz ITT	209.00
80387 600MHz INTEL	209.00	80387 600MHz ITT	219.00
80387 800MHz INTEL	219.00	80387 800MHz ITT	229.00
80387 1000MHz INTEL	229.00	80387 1000MHz ITT	239.00
80387 1333MHz INTEL	239.00	80387 1333MHz ITT	249.00
80387 1666MHz INTEL	249.00	80387 1666MHz ITT	259.00
80387 2000MHz INTEL	259.00	80387 2000MHz ITT	269.00
80387 2666MHz INTEL	269.00	80387 2666MHz ITT	279.00
80387 3333MHz INTEL	279.00	80387 3333MHz ITT	289.00
80387 4000MHz INTEL	289.00	80387 4000MHz ITT	299.00
80387 5000MHz INTEL	299.00	80387 5000MHz ITT	309.00
80387 6000MHz INTEL	309.00	80387 6000MHz ITT	319.00
80387 8000MHz INTEL	319.00	80387 8000MHz ITT	329.00
80387 10000MHz INTEL	329.00	80387 10000MHz ITT	339.00
80387 13333MHz INTEL	339.00	80387 13333MHz ITT	349.00
80387 16666MHz INTEL	349.00	80387 16666MHz ITT	359.00
80387 20000MHz INTEL	359.00	80387 20000MHz ITT	369.00
80387 26666MHz INTEL	369.00	80387 26666MHz ITT	379.00
80387 33333MHz INTEL	379.00	80387 33333MHz ITT	389.00
80387 40000MHz INTEL	389.00	80387 40000MHz ITT	399.00
80387 50000MHz INTEL	399.00	80387 50000MHz ITT	409.00
80387 60000MHz INTEL	409.00	80387 60000MHz ITT	419.00
80387 80000MHz INTEL	419.00	80387 80000MHz ITT	429.00
80387 100000MHz INTEL	429.00	80387 100000MHz ITT	439.00
80387 133333MHz INTEL	439.00	80387 133333MHz ITT	449.00
80387 166666MHz INTEL	449.00	80387 166666MHz ITT	459.00
80387 200000MHz INTEL	459.00	80387 200000MHz ITT	469.00
80387 266666MHz INTEL	469.00	80387 266666MHz ITT	479.00
80387 333333MHz INTEL	479.00	80387 333333MHz ITT	489.00
80387 400000MHz INTEL	489.00	80387 400000MHz ITT	499.00
80387 500000MHz INTEL	499.00	80387 500000MHz ITT	509.00
80387 600000MHz INTEL	509.00	80387 600000MHz ITT	519.00
80387 800000MHz INTEL	519.00	80387 800000MHz ITT	529.00
80387 1000000MHz INTEL	529.00	80387 1000000MHz ITT	539.00
80387 1333333MHz INTEL	539.00	80387 1333333MHz ITT	549.00
80387 1666666MHz INTEL	549.00	80387 1666666MHz ITT	559.00
80387 2000000MHz INTEL	559.00	80387 2000000MHz ITT	569.00
80387 2666666MHz INTEL	569.00	80387 2666666MHz ITT	579.00
80387 3333333MHz INTEL	579.00	80387 3333333MHz ITT	589.00
80387 4000000MHz INTEL	589.00	80387 4000000MHz ITT	599.00
80387 5000000MHz INTEL	599.00	80387 5000000MHz ITT	609.00
80387 6000000MHz INTEL	609.00	80387 6000000MHz ITT	619.00
80387 8000000MHz INTEL	619.00	80387 8000000MHz ITT	629.00
80387 10000000MHz INTEL	629.00	80387 10000000MHz ITT	639.00
80387 13333333MHz INTEL	639.00	80387 13333333MHz ITT	649.00
80387 16666666MHz INTEL	649.00	80387 16666666MHz ITT	659.00
80387 20000000MHz INTEL	659.00	80387 20000000MHz ITT	669.00
80387 26666666MHz INTEL	669.00	80387 26666666MHz ITT	679.00
80387 33333333MHz INTEL	679.00	80387 33333333MHz ITT	689.00
80387 40000000MHz INTEL	689.00	80387 40000000MHz ITT	699.00
80387 50000000MHz INTEL	699.00	80387 50000000MHz ITT	709.00
80387 60000000MHz INTEL	709.00	80387 60000000MHz ITT	719.00
80387 80000000MHz INTEL	719.00	80387 80000000MHz ITT	729.00
80387 100000000MHz INTEL	729.00	80387 100000000MHz ITT	739.00
80387 133333333MHz INTEL	739.00	80387 133333333MHz ITT	749.00
80387 166666666MHz INTEL	749.00	80387 166666666MHz ITT	759.00
80387 200000000MHz INTEL	759.00	80387 200000000MHz ITT	769.00
80387 266666666MHz INTEL	769.00	80387 266666666MHz ITT	779.00
80387 333333333MHz INTEL	779.00	80387 333333333MHz ITT	789.00
80387 400000000MHz INTEL	789.00	80387 400000000MHz ITT	799.00
80387 500000000MHz INTEL	799.00	80387 500000000MHz ITT	809.00
80387 600000000MHz INTEL	809.00	80387 600000000MHz ITT	819.00
80387 800000000MHz INTEL	819.00	80387 800000000MHz ITT	829.00
80387 1000000000MHz INTEL	829.00	80387 1000000000MHz ITT	839.00
80387 1333333333MHz INTEL	839.00	80387 1333333333MHz ITT	849.00
80387 1666666666MHz INTEL	849.00	80387 1666666666MHz ITT	859.00
80387 2000000000MHz INTEL	859.00	80387 2000000000MHz ITT	869.00
80387 2666666666MHz INTEL	869.00	80387 2666666666MHz ITT	879.00
80387 3333333333MHz INTEL	879.00	80387 3333333333MHz ITT	889.00
80387 4000000000MHz INTEL	889.00	80387 4000000000MHz ITT	899.00
80387 5000000000MHz INTEL	899.00	80387 5000000000MHz ITT	909.00
80387 6000000000MHz INTEL	909.00	80387 6000000000MHz ITT	919.00
80387 8000000000MHz INTEL	919.00	80387 8000000000MHz ITT	929.00
80387 10000000000MHz INTEL	929.00	80387 10000000000MHz ITT	939.00
80387 13333333333MHz INTEL	939.00	80387 13333333333MHz ITT	949.00
80387 16666666666MHz INTEL	949.00	80387 16666666666MHz ITT	959.00
80387 20000000000MHz INTEL	959.00	80387 20000000000MHz ITT	969.00
80387 26666666666MHz INTEL	969.00	80387 26666666666MHz ITT	979.00
80387 33333333333MHz INTEL	979.00	80387 33333333333MHz ITT	989.00
80387 40000000000MHz INTEL	989.00	80387 40000000000MHz ITT	999.00
80387 50000000000MHz INTEL	999.00	80387 50000000000MHz ITT	1009.00
80387 60000000000MHz INTEL	1009.00	80387 60000000000MHz ITT	1019.00
80387 80000000000MHz INTEL	1019.00	80387 80000000000MHz ITT	1029.00
80387 100000000000MHz INTEL	1029.00	80387 100000000000MHz ITT	1039.00
80387 133333333333MHz INTEL	1039.00	80387 133333333333MHz ITT	1049.00
80387 166666666666MHz INTEL	1049.00	80387 166666666666MHz ITT	1059.00
80387 200000000000MHz INTEL	1059.00	80387 200000000000MHz ITT	1069.00
80387 266666666666MHz INTEL	1069.00	80387 266666666666MHz ITT	1079.00
80387 333333333333MHz INTEL	1079.00	80387 333333333333MHz ITT	1089.00
80387 400000000000MHz INTEL	1089.00	80387 400000000000MHz ITT	1099.00
80387 500000000000MHz INTEL	1099.00	80387 500000000000MHz ITT	1109.00
80387 600000000000MHz INTEL	1109.00	80387 600000000000MHz ITT	1119.00
80387 800000000000MHz INTEL	1119.00	80387 800000000000MHz ITT	1129.00
80387 1000000000000MHz INTEL	1129.00	80387 1000000000000MHz ITT	1139.00
80387 1333333333333MHz INTEL	1139.00	80387 1333333333333MHz ITT	1149.00
80387 1666666666666MHz INTEL	1149.00	80387 1666666666666MHz ITT	1159.00
80387 2000000000000MHz INTEL	1159.00	80387 2000000000000MHz ITT	1169.00
80387 2666666666666MHz INTEL	1169.00	80387 2666666666666MHz ITT	1179.00
80387 3333333333333MHz INTEL	1179.00	80387 3333333333333MHz ITT	1189.00
80387 4000000000000MHz INTEL	1189.00	80387 4000000000000MHz ITT	1199.00
80387 5000000000000MHz INTEL	1199.00	80387 5000000000000MHz ITT	1209.00
80387 6000000000000MHz INTEL	1209.00	80387 6000000000000MHz ITT	1219.00
80387 8000000000000MHz INTEL	1219.00	80387 8000000000000MHz ITT	1229.00
80387 10000000000000MHz INTEL	1229.00	80387 10000000000000MHz ITT	1239.00
80387 13333333333333MHz INTEL	1239.00	80387 13333333333333MHz ITT	1249.00
80387 16666666666666MHz INTEL	1249.00	80387 16666666666666MHz ITT	1259.00
80387 20000000000000MHz INTEL	1259.00	80387 20000000000000MHz ITT	1269.00
80387 26666666666666MHz INTEL	1269.00	80387 26666666666666MHz ITT	1279.00
80387 33333333333333MHz INTEL	1279.00	80387 33333333333333MHz ITT	1289.00
80387 40000000000000MHz INTEL	1289.00	80387 40000000000000MHz ITT	1299.00
80387 50000000000000MHz INTEL	1299.00	80387 50000000000000MHz ITT	1309.00
80387 60000000000000MHz INTEL	1309.00	80387 60000000000000MHz ITT	1319.00
80387 80000000000000MHz INTEL	1319.00	80387 80000000000000MHz ITT	1329.00
80387 100000000000000MHz INTEL	1329.00	80387 100000000000000MHz ITT	1339.00
80387 133333333333333MHz INTEL	1339.00	80387 133333333333333MHz ITT	1349.00
80387 166666666666666MHz INTEL	1349.00	80387 166666666666666MHz ITT	1359.00
80387 200000000000000MHz INTEL	1359.00	80387 200000000000000MHz ITT	1369.00
80387 266666666666666MHz INTEL	1369.00	80387 266666666666666MHz ITT	1379.00
80387 333333333333333MHz INTEL	1379.00	80387 333333333333333MHz ITT	1389.00
80387 400000000000000MHz INTEL	1389.00	80387 400000000000000MHz ITT	1399.00
80387 500000000000000MHz INTEL	1399.00	80387 500000000000000MHz ITT	1409.00
80387 600000000000000MHz INTEL	1409.00	80387 600000000000000MHz ITT	1419.00
80387 800000000000000MHz INTEL	1419.00	80387 800000000000000MHz ITT	1429.00
80387 1000000000000000MHz INTEL	1429.00	80387 1000000000000000MHz ITT	1439.00
80387 1333333333333333MHz INTEL	1439.00	80387 1333333333333333MHz ITT	1449.00
80387 1666666666666666MHz INTEL	1449.00	80387 1666666666666666MHz ITT	1459.00
80387 2000000000000000MHz INTEL	1459.00	80387 2000000000000000MHz ITT	1469.00
80387 2666666666666666MHz INTEL	1469.00	80387 2666666666666666MHz ITT	1479.00
80387 3333333333333333MHz INTEL	1479.00	80387 3333333333333333MHz ITT	1489.00
80387 4000000000000000MHz INTEL	1489.00	80387 4000000000000000MHz ITT	1499.00
80387 5000000000000000MHz INTEL	1499.00	80387 5000000000000000MHz ITT	1509.00
80387 6000000000000000MHz INTEL	1509.00	80387 6000000000000000MHz ITT	1519.00
80387 8000000000000000MHz INTEL	1519.00	80387 8000000000000000MHz ITT	1529.00
80387 10000000000000000MHz INTEL	1529.00	80387 10000000000000000MHz ITT	1539.00
80387 13333333333333333MHz INTEL	1539.00	80387 13333333333333333MHz ITT	1549.00
80387 16666666666666666MHz INTEL	1549.00	80387 16666666666666666MHz ITT	1559.00
80387 20000000000000000MHz INTEL	1559.00	80387 20000000000000000MHz ITT	1569.00
80387 26666666666666666MHz INTEL	1569.00	80387 26666666666666666MHz ITT	1579.00
80387 33333333333333333MHz INTEL	1579.00	80387 33333333333333333MHz ITT	1589.00
80387 40000000000000000MHz INTEL	1589.00	80387 40000000000000000MHz ITT	1599.00
80387 50000000000000000MHz INTEL	1599.00	80387 50000000000000000MHz ITT	1609.00
80387 60000000000000000MHz INTEL	1609.00	80387 60000000000000000MHz ITT	1619.00
80387 80000000000000000MHz INTEL	1619.00		



N45SL-120 meg, notebook	1995
N51SX-80 meg, notebook	CALL
ThinkPad 700-120	2750
ThinkPad 700C-120	4050
PS/2 9 57-160 meg	2370

Manager's Special

*IBM ValuePoint 486 DX2/66, 212 MB	2450
--	------



MEGACUBE EISA BUS

486-33 Mhz System	
8 meg, 128K Cache, SCSI	CALL

Carrier 386sx/25 Mhz Notebook

4 meg, 120 meg Hard Drive, VGA	CALL
--------------------------------------	------

TOSHIBA NOTEBOOKS

Toshiba 1850, 80 meg	1895
Toshiba 4400c, 120 meg	3625
Toshiba 6400sxc, 120 meg	CALL
Toshiba 3300sl, 80 meg	CALL
Toshiba 4500, 120 meg	CALL
Toshiba 4500C, 200 meg	CALL

Call for pricing on other brand name models

CD ROM/Multi Media

NEC CD ROM 36M Gallery	570
NEC CD ROM 74M Gallery	680
Sound Blaster Pro	205

BRAND NAMES

LOW PRICES LEADER SINCE 1983

We export to Europe, Asia

Notebook Memory

Compaq Contura 4/8MB	\$215/430
Toshiba T4400 4/8MB	\$235/460
AST Exec. 4MB	\$290
Texas Instruments TM4000 4MB	\$225

AST

Power Exec 386SL/25, 60 meg	2185
Power Exec 386SL/25, 120 meg	2555
Power Exec 386SL/25C, 80 meg	3195
Power Exec 386SL/25C, 120 meg	3575
Power Exec 486SL25	CALL
Power Exec 486SL25C	CALL
Power Premium 4/50	2290
Power Premium 4/33	1995

(HARD DISK & MONITOR EXTRA)



ProLinea 3/25s, 84 MB	909
ProLinea 4/25s, 240 MB	1595
Prolinea 4/50, 240 MB	2275
DESKPRO 3/25i, 120 MB	1695
DESKPRO 4/25is, 120 MB	1810
DESKPRO 4/66i, 210 MB	2675
DESKPRO 386/33M, 120 MB	2335
DESKPRO 486/33M, 340 MB	3520
DESKPRO 50M, 340 MB	3995
DESKPRO 66M, 510 MB	4730
Portable 486, 210 MB	CALL
Portable 486c (color), 210 MB	CALL
Contura 386SL/25, 120 MB	CALL
LTE Lite/25, 120 MB	CALL
LTE Lite/25c, (color), 120 MB	CALL
LTE Lite 4/25	CALL

SYSTEMPRO/LT

486/33, 1020 MB	7552
486DX2/50, 1020 MB	9350

*Call for other models - Monitor Extra *



NOVELL SPECIALS

Netware 386 V.3.11

Authorized Dealer

5 users	695
10 users	1395
20 users	1895
100 users	3795
250 users	CALL

WE STOCK SHARP NOTEBOOK TEXAS INSTRUMENTS

CITIZEN
OKIDATA
EPSON

HITACHI
TALLGRASS
ARCHIVE

NEC
ALR
WYSE

HOUSTON INSTRUMENTS
MICROSOFT
SUMMAGRAPHIC

INTEL
PC MOUSE
CALCOMP

AES Computers

All systems include

Made
in
USA

- Intel CPU with 4 meg RAM
- Desktop or tower case
- 2 serial, 1 parallel, 1 game (joystick) ports
- 101 AT enhanced keyboard
- 1.2 (5.25") & 1.44 (3.5") TEAC floppy drives
- SVGA card w/1 meg & SVGA 0.28mm monitor
- MS DOS 5.0 (complete w/manuals)
- MS Windows 3.1 (complete w/manuals) & mouse

486/50 with 200 meg HD	2150
486/33 with 120 meg HD	1860
386/40 with 120 meg HD	1390
386SX/25 with 40 meg HD	950

One year limited warranty

LAN BOARDS

8 bit Arcnet	75
16 bit Arcnet	160
Novell NE 1000	160
Novell NE 2000	175
8 port Active Hub	325
Token Ring Card	399
Tokenhub 4-port	355
Call for other LAN Accessories	

SVGA Monitors

NEC 3FGX, 14"	665
NEC 4FG, 16"	825
Viewsonic 4E, 14"	365
Viewsonic 8, 17"	1785
Aamazing, 14"	335

PRINTERS

Panasonic 2180	289
Panasonic 2624	390
OKIDATA ML320	315
OKIDATA ML390	460
HP DeskJet 500 & 550	399
HP DeskJet 550c	699
HP PaintJet	705
Epson, Citizen	CALL

LASER PRINTERS

HP LaserJet IIISI	3595
HP LaserJet IIID	CALL
HP LaserJet IV	1495
HP LaserJet IIIP	CALL
HP LaserJet IIP Plus	CALL
HP Laser 4M	1995
OKI OL 400, 800	CALL
OKI OL 840 P.S.	1720
Panasonic 4450	1295
NEC Model 95	1395
NEC Model 97	CALL
Compaq Pagemarq 20	4095

HARD DISKS

CONNER	
CP30104 120 meg	CALL
CP3204F 220 meg	CALL
QUANTUM	
Pro Drive 120 meg	CALL
Pro Drive 240 meg	CALL
MAXTOR, SEAGATE	
MICROPOLIS, MICRONET	
CALL FOR ALL MODELS	

Computerlane inc.

Corporate Accounts
Welcome

Call for Discounts
on Volume

And
Consultant Orders

Outside California: 1-800-526-3482

Inside California: 818-884-8644 • FAX: 818-884-8253

7500 Topanga Canyon Boulevard, Canoga Park, CA 91303

Hours: Monday - Friday 9 - 6, Saturday 10 - 5

Compaq is a Registered Trademark of Compaq. IBM is a Registered Trademark of International Business Machines.

ALL QUOTED
PRICES REFLECT
A 5% CASH DISCOUNT

Visa, MasterCard
and
American Express
also accepted

Prices subject to change without notice.
*Quantities are limited

**Your Super Direct source
for computers, hardware
and software.**

**GET IT
ALL WITH
INSIGHT**

- 486 ISA, EISA & Local Bus Computers
- Multimedia Kits
- Notebooks
- Hard Drives
- Removable Drives
- Monitors
- Printers
- CD-ROM Drives & Software
- Power Drives
- Tape Backups
- Memory
- Networking Products
- Fault Tolerant Disk Arrays
- Software



Insight

**Buy the
Super
Direct™
way!**

**Super Selection.™
Super Service. Super Direct!**

Insight 486 ISA

Fully Upgradable Intel 80486 CPU
4MB RAM - 256K Cache
210MB 12ms Hard Drive w/cache
420MB with Stacker®
Non-Interlaced 14" Super VGA
Color Monitor
24 Bit 1MB Graphics Accelerator
Super VGA Video Card -
Up to 16 Million Colors
1.2MB 5.25" Floppy Drive
1.44MB 3.5" Floppy Drive
2 Serial Ports, 1 Parallel, 1 Game Port
Enhanced 101 Key Keyboard
MS-DOS 5.0
Mouse
Full Vertical Case
250 Watt Power Supply
Stacker and Dr. Solomon's
Anti-Virus™ Software
Intel OverDrive™ Socket

486SX-25MHz

\$1,599

486-33MHz

\$1,899
**SUPER
BUY!**

486DX2-50MHz

\$1,999

486-50MHz

\$2,099

486DX2-66MHz

\$2,299


**Faster Than A
Speeding Bullet!**

No time to wait for a fully-loaded, value-packed 486? No problem! We've specially configured and pre-built our hottest selling systems and they're ready to ship!

CD-ROM

Talon TA-100

Internal, 380ms access time, 32KB buffer, fast transfer rate. **\$279**

Sony S-31A

Internal, 490ms access time, 64KB buffer, 150KB/second transfer rate. Photo CD compatible. **\$399**

Talon High Performance TA-200

Internal, 280ms access time, 64KB buffer, 300KB/second transfer rate. **\$599**

Free with any CD-ROM drive -

- 1992 Multimedia Encyclopedia
- Stereo Headphones
- Reference Library
- Game Pack.



1992 Toolworks Multimedia Encyclopedia - complete 21 volume set. Over 33,000 articles with 3,000 pictures, 250 maps, 35 minutes of video, 35 minutes of sound recordings and 55 video sequences.

CD Software - Pick 5 for \$99*







Aircraft Encyclopedia	Nat'l Parks
Bible Library	Plant Doctor
Career Opportunities	Shareware Gold
CIA Factbook	Software Jukebox
Civil War	Space-Apollo
European Monarchs	Timetable of Arts
Guinness Disc	Timetable of Sci.
Great Cities (MM)	USA State Fact Book
Interactive Storytime	US Atlas
KGB Factbook	US Civics
Korea	US Presidents
MM Mavis Beacon	Vietnam
Teaches Typing	World Atlas
N. American Indians	World War II
American Business	
Phone Book	

*with purchase of a CD-ROM Drive or Multimedia Kit.



1000's of Products. Call Now!

120MB to 2100MB Hard Drives

120MB  IDE	170MB  IDE	210MB   IDE
Talon TA3020A, 16ms, 3.5" 1"H Bare \$279 8 Bit Kit \$319 16 Bit Kit \$299	Western Digital WD2170A, 12ms 3.5" 1"H Bare \$349 16 Bit Kit \$369	Western Digital WD2200A, 12ms 3.5" 1"H Bare \$399 16 Bit Kit \$419
520MB  IDE/SCSI	660MB SCSI	1080MB  SCSI
Fujitsu FJ2624S, 12ms 3.5" HH Bare \$999 16 Bit Kit (IDE) \$1,019 16 Bit Kit (SCSI) \$1,149	Micropolis MC1624, 15ms 5.25" HH Bare \$1,199 16 Bit Kit \$1,349	Fujitsu FJ2266S, 14.5ms 5.25" FH Bare \$1,499 16 Bit Kit \$1,649
1350MB SCSI	1752MB SCSI	2100MB SCSI
Micropolis MC1528-15, 14ms 5.25" FH Bare \$1,799 16 Bit Kit \$1,949	Fujitsu FJ2652S, 11ms 5.25" FH Bare \$2,749 16 Bit Kit \$2,899	Micropolis MC1924, 11ms 5.25" FH Bare \$3,199 16 Bit Kit \$3,349

Tape Backups

Standard QIC 80 attaches to existing floppy controller or dedicated unit, w/ data compression. 2-3MB/min.

Talon By Colorado

120MB includes one tape	\$189
250MB includes one tape	\$249

Colorado

120MB	\$199
250MB	\$259

Printers

Canon

BJ-10ex Bubble Jet	\$289
BJ-20 Bubble Jet	\$379
BJ-200 Bubble Jet	\$339
BJ-300 Bubble Jet	\$419
BJ-330 Bubble Jet	\$579
BJC-800 Color Bubble Jet	\$1,899
BJC-820 (SCSI) Color Bubble Jet	\$1,999
LBP-4sx	\$899
LPB-8sx	\$1,399

NEC

P3200 - 8K, up to 216 CPS	\$229
P6200 - 80K, up to 300 CPS	\$409
P3300 - 8K, up to 216 CPS	\$329
P6300 - 80K, up to 300 CPS	\$629
P9300 - 80K, up to 400 CPS	\$829
Model 95 Laser Printer	\$1,399

WangDAT Tape Backups

2 GB 3100 Internal 16 Bit Kit	\$1,199
4 GB 3200 Internal 16 Bit Kit	\$1,399
4 GB 3200 External 16 Bit Kit	\$1,499

Monitors

TVM

MediaScan 4A+ 14"	\$319
Low Radiation 5A+ 15"	\$529
MediaScan 6A 17"	\$1,039

NSA/Hitachi

SuperScan™ 15 (CM1584)	\$579
SuperScan™ 17 (CM1785)	\$1,099
SuperScan™ 20 (CM2085)	\$1,499

NEC

MultiSync 3FGx 15"	\$639
MultiSync 4FG 15"	\$749
MultiSync 5FG 17"	\$1,349
MultiSync 6FG 21"	\$2,359

Bernoulli

Removable media, offers a 90 Pro internal drive, SCSI adapter by Rancho Technology, up to 360MB of storage, 2 90MB cartridges and Stacker® disk compression software.

Internal 360MB Kit	\$499
Extra Cartridges	\$149
3 Pack of Cartridges	\$419

OMEGA®

Software

Automap	\$49
Lotus SmartSuite for Windows	\$419
Microsoft Excel 4.0	\$295
Microsoft Word 2.0	\$295
Paradox 4.0	\$499

Networking

ARTISOFT Revolutionizing Connectivity	
LANTastic® AE-2™	
Ethernet Starter Kit (ISA)	\$479
LANTastic AE-3™	
Ethernet Starter Kit (ISA)	\$549
Other Networking Products Available.	

All versions and upgrades available at the lowest prices.



Hard Drives International and Insight have joined forces

to bring you a superstore in your mailbox. We offer the ultimate selection of today's most popular hardware and software, with the most affordable prices. Get Insight's superior service and support, plus 1000's of products to choose from. It's the Super Direct™ way to have it all - direct to your door faster than a speeding bullet.

Super selection.

You'll find everything you need at Insight. From high-capacity, high-performance storage products to computer systems, peripherals, software and more. If you don't see the product you need, call us. We have 1000's of products in stock.

Super service.

- 30-Day "Worry-Free" Money Back Guarantee
- Federal Express Delivery
- Toll-Free Technical Support 7 Days a Week
- Payment Options Galore
- Order 24hrs a Day
- One Year Parts & Labor Warranty/Replacement Policy
- Special National Accounts Department for Larger Customers



Super Direct™

Order 24 Hours a Day
800-998-8062
National Accounts - P.O.s
800-998-8014
APO/FPO/International
602-350-1145
FAX 602-350-1188

Insight Distribution Network Inc.
1912 W. Fourth St.
Tempe, AZ 85281
PH. 602/350-1128
FAX 602/350-1150

Source Code 8040

800-998-8040

Insight Buy the
Super
Direct™
way!

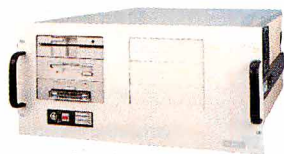
CALL 1-800-FONE-ACP TOLL-FREE ORDERS

Circle 166 on Inquiry Card (RESELLERS: 167).



Rack Mount Computers - Motherboard or Passive Backplane

Use external monitor
Up to 6 drives



8.75" high

Mono or color monitor
Up to 5 drives



8.75" high

14" color monitor
Up to 3 drives



12.25" high

Rack Mount Monitors

10" mono or color
monitor



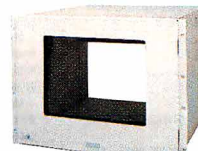
8.75" high

14" mono or color
monitor



12.25" high

Enclosure for most
desk top monitors



14.0" high

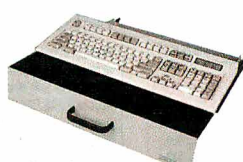
Rack Mount Keyboards

Drawer mounted
keyboard



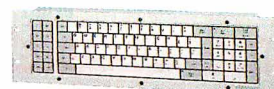
1.75" high

Drawer for desk top
keyboards



3.5" high

Vertical-mount, sealed
membrane keyboard



5.25" high

Rack Mount Printer

Dot matrix printer with
industrial rating



12.25" high

Call for our other Rack Mount computer
and "enclosure only" product offerings.

RECORTEC, INC.

1290 Lawrence Station Road, Sunnyvale CA 94089
Tel. [408] 734-1290 Fax: [408] 734-2140

1-800-729-7654

MEMORY AND MORE...

30 day
Money Back Guarantee
Buy with confidence!

First Source International
"The Only Source for Computer Upgrades"

Personal Computer Memory

IBM	
PS/1 286, 386SX	
2MB 92F9935 \$79	4MB 92F9694 \$149
PS/1 Consultant, Essential & Expert models x43, x44 & PS/Valuepoint all models except Cx series	
4MB PN NA \$159	16MB PN NA \$579
PS/1 Consultant, Essential & Expert models x76	
16MB Kit \$579	
PS/2 25/286, 30/286, & memory adapter 1497259	
2MB Kit \$89	
PS/2 355X; LS, 405X, 50Z, 555X; LS, 655X; LS, 70, & Xstation	
1MB \$49	
2MB \$79	
PS/2 70-A21; A61; B21; B61, PS/1 Consultant, Essential & Expert models x11, x13 & x14, PS/Valuepoint Cx series	
2MB \$79	
PS/2 355X; LS, 405X, 555X; LS, 655X; LS, Xstation, PS/Valuepoint Cx series & adapter board 34F3077	
4MB \$159	
PS/2 355X; LS, 405X, PS/Valuepoint Cx series	
8MB \$309	
PS/2 90 XP, 95 XP, P75 (pairs), 56, 57 (all), PS/1 Pro 2123	
2MB \$89	
PS/2 90, 95 XP, P75 (pairs), 56, 57 (all), PS/1 Consultant, Essential, Expert x11, x13 & x14, PS/1 Pro 2123, RS/6000	
4MB \$509	
Expansion boards for 50, 50Z, 555X, 60, 65X	
2-8MB w/2MB \$269	
Expansion boards for all models 70 & 80	
2-14MB w/2MB \$329	
Compaq	
ProLinea 3/25S; 3/25S	
2MB 14738-001 \$89	8MB 14742-001 \$289
ProLinea 4/25S, 4/33, 4/50	
1MB 14682-001 \$59	2MB 14683-001 \$89
4MB 14684-001 \$159	8MB 14685-001 \$309
DeskPro 386-20, 20e & 25	
4MB \$169	
DeskPro 386S/16	
4MB \$169	
DeskPro 286N; 386N; I Series; 386SX/20; 20N; Portable 486C; M Series expansion boards; SystemPro LT Series	
1MB 118688-001 \$49	2MB 118689-001 \$79
4MB 118690-001 \$159	8MB 118691-001 \$309
DeskPro 386-33, 486-33 & SystemPro	
2MB 115104-001 \$99	8MB 115651-001 \$289
DeskPro 386M, 486M, SystemPro LT (32-Bit Exp. board)	
2-64MB w/2M \$359	
DeskPro 386/33L, 486/33L, SystemPro	
6 Socket Brd w/2MB 115659 + 115104-001 \$389	
DELL	
Power Desktop 325D & P, 333D & P, 433P, 486P & 486D	
1MB 310-2505 \$59	4MB 310-2507 \$169
PowerLine Workstation 420; 25; 33; 50; 450DE/2 & 460DE	
1MB 310-2466 \$119	4MB 310-2467 \$199
8MB 310-2468 \$349	16MB 310-2469 \$669

Laptop & Notebook Memory

AST	
PowerExec 3/25S, 3/25S-C	
1MB \$179	
4MB \$129	
Premium Exec 386SX/25, 25C	
1MB \$69	
4MB \$129	
Compaq	
Contura 3/20, 3/25 & 25C	
4MB \$199	
8MB \$429	
LTE 286	
2MB \$99	
4MB \$199	
LTE 386S/20	
2MB \$139	
LTE Lite 20; 25; 25C	
2MB \$229	
SLT 286	
1MB \$99	
4MB \$279	
SLT 386S/20	
1MB \$89	
4MB \$199	
IBM	
ThinkPad 300	
2MB \$159	
8MB \$459	
16MB \$349	
PS/2 CL575X & ThinkPad 700; 700C	
8MB \$669	
N51 Notebook (All)	
2MB \$179	
4MB \$249	
8MB \$355	
16MB \$285	
NEC	
UltraLite & Cellular Workstation 286F	
1MB \$139	
4MB \$369	
UltraLite & Cellular Workstation SK/20	
2MB \$179	
4MB \$599	
UltraLite III, SL/25C	
2MB \$149	
4MB \$249	
UltraLite SL/20, SL/20P	
2MB \$239	
4MB \$109	
ProSpeed 286, 386SX/16	
1MB \$209	
4MB \$149	
Panasonic	
CF-170, CF-270, CF-370	
1MB \$59	

Zenith	
Z-300/400 Series Z-420/SX, Z-425/SX, Z-433/DX, Z-433/SX	
4MB ME-100 \$159	16MB ME-90 \$599
Z-Server 425SE, 433DE, 450DE	
4MB ME-432 \$179	8MB ME-102 \$329
16MB ME-442 \$649	32MB ME-92 \$1239
Z-Station 325Sn, 420SEh; Sh; Sn, 425Sn, 433DEh; Dh, 50Xen	
1MB ME-700 \$49	4MB ME-100 \$149
Zenith Z-386/20; 25; 33 & 33E	
1MB ZAS800ME \$49	4MB ZAS800MK \$159
Zenith Z-386SX/20, 286LP+, Z-LS	
2MB Kit \$99	
Zenith 486/33ET; 25E	
4MB Z4A200M2 \$189	16MB Z4A200M8 \$599
AST	
Bravo 386-SX, WS/286, 386	
2MB 500510-002 \$89	4MB 500510-008 \$179
Bravo 3/25S	
2MB 500710-004 \$99	8MB 500824-002 \$319
Bravo 3/33S	
2MB 500962-001 \$75	8MB 500962-002 \$379
Bravo LC 4/25S, 4/33, 4/33S, 4/50, 4/66d	
4MB 500987-002 \$149	8MB 500987-003 \$299
16MB 500987-004 \$589	32MB 500987-005 \$159
Premium 386/25; 33; 33T, Premium II 386SX/16; 20; 25	
1MB w/WPB \$99	
Bravo 4/33; 486/25; Premium 4/25; 33TE, Server SE 4/33	
2MB w/WPB \$119	
Power Premium 3/33, 4/33, 4/33S, 4/50, 4/66d	
Premium 386/33TE, 486/25, 25E, 33E, 33S, 33TE, Premium II 3/25, 33, 486/33, 486SX/20 & Server SE 4/33	
4MB 500780-004 \$145	8MB 500780-001 \$289
Hewlett-Packard	
Vectra 386/16N, 386/20N, 386/25N PC	
2MB D2406A \$99	8MB D2404A \$319
Vectra 486PC; 25T; 33T; 486S/20; 486/25N; 33N; 50N; 66N	
2MB D2581A \$89	8MB D2152A \$309
4MB D2151A or D2156A \$169	
Vectra 386/25; 486/25U; 486/33U; 486/50U; 486/66U	
2MB D2581A \$89	8MB D2152A \$309
Vectra 486/25N; 486/33N; 486/50N; 486/66N	
16MB D2676A \$599	
NEC	
PowerMate 286/12; SX/16 & SX/20	
2MB Kit \$99	
PowerMate SX/20	
2MB CPU Upgrade \$189	
2MB Exp. Board \$209	
PowerMate 386/33E & 486/25E	
2MB \$199	
DEC	
DECstation 3 series SX; C Plus; & 425c	
2MB PCAXM-CB \$99	
DECpc 400ST series	
4MB PCTAM-CC \$189	8MB PCTAM-CD \$299

We stock memory for most discontinued systems!

Kingston TECHNOLOGY CORPORATION

386 & 486 Processor Upgrades for your system!

Now you can use Windows in enhanced mode, get true multitasking & background operation for Windows 3.1, OS/2, & other 386 specific software. Processor upgrades offer dramatically increased system performance & easy installation & Improves your systems performance by up to 350%.

CPU Upgrades (CPU socket)

From 286 to 386SX

25MHz SX/Now!	\$299
33MHz SX/Now!	\$329
Add a math coprocessor for	\$75

From 386 to 486

25MHz 486SX/Now!	\$429
33MHz 486DX/Now!	\$769

MicroMaster Upgrades (expansion slot)

From 286 & 386 to 486

25MHz 486SX MicroMaster	\$829
33MHz 486DX MicroMaster	\$1299

MicroMaster with 32-bit 70ns Memory

25MHz 486SX with 4MB	\$999
with 8MB	\$1179
with 16MB	\$1519
33MHz 486DX with 4MB	\$1439
with 8MB	\$1619
with 16MB	\$1959

Megahertz CORPORATION

Laptop & Notebook FAX/Modems

for AST, Compaq, IBM, Sharp, TI, Toshiba, Zenith and many other Laptop & Notebook Systems.

Megahertz modems include:

- Send & Receive Fax capability
- Easy installation with illustrated user's guide
- Software included
- Free technical support
- Full 5-year warranty
- Hayes compatible

PCMCIA 2.0 FAX/Modems with XJACK

14,000bps FAX/Modem, Cellular, Autosync	\$call
24/9600bps FAX/Modem	\$call
Internal FAX/Modems w/MNP-5 & V.42/V.42bis	
14,000bps FAX/Modem, Cellular, Autosync	\$549
96/9600bps FAX/Modem	\$499
24/9600bps FAX/Modem	\$229
2400bps Modem	\$149
External Pocket Modems for any RS-232 Serial Port	
14,000bps FAX/Modem, Cellular, Autosync	\$469
9600bps FAX/Modem	\$399
24/9600bps FAX/Modem	\$229

Laser Memory

Compaq PAGEMARK 15 & 20	
8MB 126361-001 \$329	16MB 126361-001 \$649
Hewlett-Packard LaserJet IIIi, 4, 4M & XL300	
4MB C2065A \$149	8MB C2066A \$299
Hewlett-Packard LaserJet IIP, III, IIIP, IIID	
2MB 33475B \$99	4MB 33477B \$159
Hewlett-Packard LaserJet I & IID	
2MB 33444B \$102	4MB 33445B \$160
Hewlett-Packard DeskJet 500, 500C	
256K 22707B \$59	
IBM Laser 4029 All Models	
4MB 118333S \$129	
Canon LBP-4, 4Lite, 4Plus	
1MB 563-2230 \$119	2MB N/A \$169
Canon LBP-III & IIIi Plus	
2MB 563-2350 \$249	3MB 563-2360 \$299
Panasonic 4410 & 4430	
2MB KX-P441 \$119	4MB N/A \$189
Panasonic 4450I & 4420	
2MB KX-P441 \$119	4MB N/A \$189
OkiLaser 400	
1MB 70014701 \$79	
2MB Oki N/A \$99	
Texas Instruments MicroLaser & XL	
1MB 255739-0001 \$49	
Epson EPL 6000	
2MB IBS401 \$99	4MB N/A \$169
Epson ActionLaser II, EPL-8000	
2MB N/A \$169	4MB N/A \$259

- 30 Day Money Back Guarantee
- 100% compatible in form, fit, & function
- User installable products
- Installation instructions included
- Toll-free technical support
- Thousands of items in stock
- Manufacturer's warranties
- Corporate PO's, APO/FPO's
- Government & Educational pricing
- International orders welcome
- Special volume pricing
- 24-hour fax line
- Same day shipping
- Overnight delivery available

- Visa, MC, AMEX, & Discover accepted
- No surcharge on credit cards
- Call for any items not listed
- We'll meet or beat any advertised price

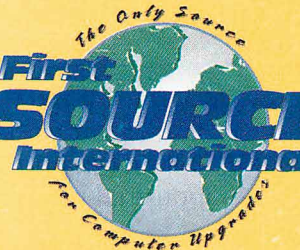
Toll free from anywhere
in the United States or Canada

800/336-9866

International
714/588-9866

Facsimile
714/588-9872

Business Hours
Monday-Friday, 8AM-5PM
Saturday, 10AM-3PM, P.S.T.



Mail orders to:
First Source International, Inc.
36 Argonaut, Suite 140
Aliso Viejo, California 92656 USA

Terms & Conditions
Memory products are third party manufacturers' part numbers are for your convenience. Freight charges are non-refundable. A 20% restocking fee will be charged on all non-defective returns, unopened, & refused or cancelled orders. Items must be returned within 15 days with original documentation & packaging. A Returned Merchandise Authorization number is required. Prices & availability are subject to change without notice. Purchase prices at the time of order are final. First Source International cannot be responsible for errors in typographical or photographic. We will beat any advertised price valid only on identical brands, offer not good for SIMMS or DRAM. Trademarks & registered trademarks are of their respective companies.

CALL THE UPGRADE EXPERTS TOLL FREE 800/336-9866



DPT

Break into Higher Performance!

SmartCache Plus is the SCSI controller that delivers higher performance without a higher price!

Windows, Netware, Unix and other high-end applications need a SCSI controller that delivers top disk I/O performance and a growth path. Only SmartCache Plus delivers both — and costs no more than less advanced controllers!

As the industry's fastest SCSI controller, SmartCache Plus is the easy choice. It's the smart choice, too — because if your system needs a performance boost, you can transform it from a non-caching host adapter into the world's fastest *caching* controller! Expandability is so simple: plug-on modules add caching, up to a total of 16MB of cache memory, and disk mirroring!

SmartCache Plus is supported by all major operating systems and applications, and provides connectivity to hundreds of SCSI devices. Reliable, scalable and simple to install, SmartCache Plus breaks your system's disk I/O bottleneck without breaking your budget!

*Distributed Processing Technology
140 Candace Drive, Maitland, FL 32751 USA*

All trademarks are the property of their respective owners.

Circle 172 on Inquiry Card (RESELLERS: 173).

GET THE FACTS!



This free comprehensive Performance Report details the SmartCache Plus advantage over its leading competitor in nine different benchmarks for DOS 5.0, Netware 3.11 and Unix applications. For your copy, contact DPT Channel Marketing today...

TEL. **407-830-5522**
FAX **407-260-5366**

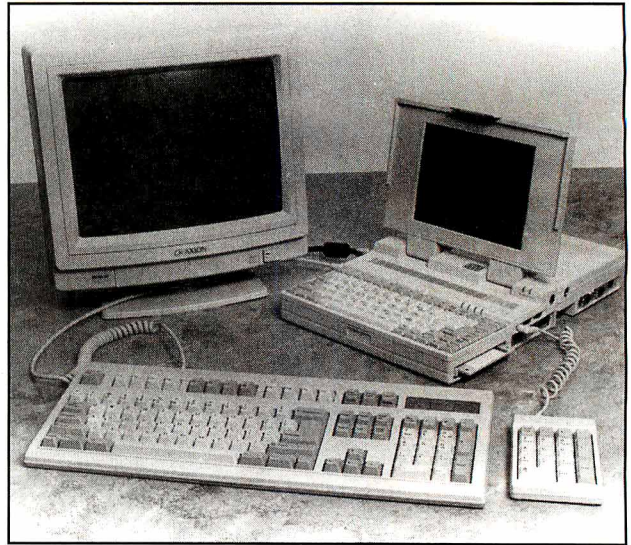
Micro-International Inc.

since 1984, world-wide distribution of quality computer systems and components



486DX2, 66 MHz, \$2970

486DX2, 50 MHz, \$2640



486DX, 33 MHz, \$2440

386DX, 33 MHz, \$2060

Don't settle for 386SX performance. With 386DX and 486DX power, external keyboard and VGA ports, it is the only computer you will ever need.

HCP Power Notebook Standard Features

- VGA graphics with 32 gray-scale supertwist back-lit LCD screen
- 4 MB RAM installed, total memory capacity is 16 MB
- 120 MB hard disk, 15 ms access time
- 1.44 MB floppy drive
- Three-hour battery
- Carrying case
- Licensed DR-DOS 6.0
- Two serial, one parallel port
- External numeric keypad included
- External VGA and keyboard connections

Optional Features

- | | | | |
|---|-------|--------------------------------|-------|
| ▪ Docking station with 2 x 16 bit slots | \$160 | ▪ Hard drive upgrade to 210 MB | \$200 |
| ▪ Auto cigarette adapter | \$ 40 | ▪ Additional battery set | \$ 90 |
| ▪ Memory upgrade to 16 MB | \$380 | ▪ Additional battery charger | \$ 30 |
| ▪ Memory upgrade to 8 MB | \$160 | ▪ Additional AC power adapter | \$ 50 |

Micro-International, Inc.



10850 Seaboard Loop
Houston, Texas 77099



National Sales 800/967-5667 Houston 713/495-9096

Hours: 9:00 a.m. to 5:00 p.m. M-F, 11:00 a.m. to 1 p.m. Sat. (Central Time)

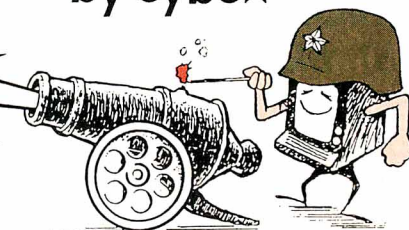
All systems and components include a one-year warranty; 30-day money-back guarantee.

Price reflects cash or credit card payment. Major corporation purchase orders accepted.

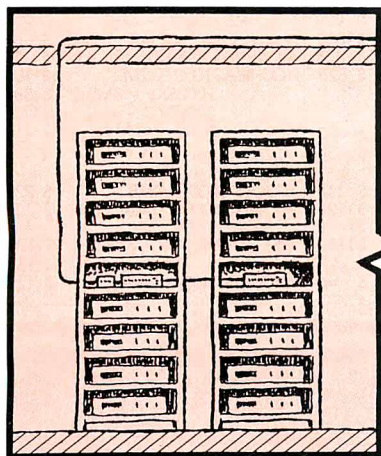
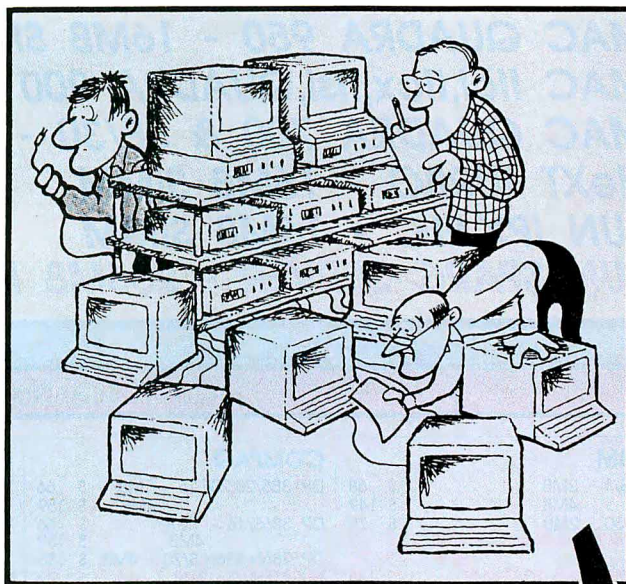
CONTROL UP TO **96** PC FILE SERVERS WITH **1** KEYBOARD AND MONITOR USING...

COMMANDER

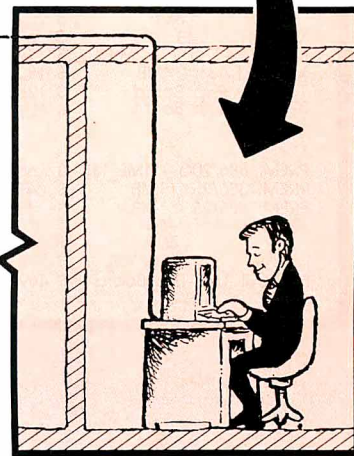
by cybex



- **Select via Keyboard**
- **Dual access up to 250 feet away (optional)**
- **No external power**
- **Mix PC, PC/XT, PC/AT and PS/2**
- **"AutoBoot™" Feature boots attached computers without operator intervention**
- **Shows PC power status**



- **PS/2 Mouse support available**
- **Each unit accommodates from 2 to 8 PCs**
- **Up to 12 units can be cascaded**
- **Mounting kit available for 19" and 24" rack installation**



Dealer Program Available

Cybex Corporation

2800-H Bob Wallace Ave.
Huntsville, Alabama 35805

(205) 534-0011

Fax (205) 534-0010

PC, PC/XT, PC/AT and PS/2 are trademarks of International Business Machines Corp.

MEMORY !! MEMORY !! MEMORY !!

ACER 486sx - 16MB SIMM (4M X 36)	\$ 529.00
32MB SIMM (8M X 36)	\$ 1,599.00
AMI EZ-FLEX - 64MB KIT (4 SIMMS)	\$ 2,799.00
AMIGA 2000 - 16MB SIMM	\$ 469.00
AST BRAVO 486LC - 16MB SIMM	\$ 469.00
COMPAQ SystemPro - 32MB MODULE	\$ 1,199.00
DELL 486's - 16MB KIT (2 SIMMS)	\$ 538.00
32MB KIT (2 SIMMS)	\$ 1,088.00
MAC IIfx - 16MB SIMM	\$ 479.00
MAC QUADRA 950 - 16MB SIMM	\$ 469.00
MAC IIfx, IIfx, IIfx, QUADRA 900 - 16MB SIMM	\$ 469.00
MAC QUADRA 700 & SE/30 - 16MB SIMM	\$ 529.00
NeXT TURBO - 16MB SIMM	\$ 469.00
SUN IPX, ELC - 16MB SIMM	\$ 499.00
SUN SPARC SERVER - 256MB KIT	CALL

OTHER MEMORIES AVAILABLE...

IBM

PS/1 - 2MB	\$ 68
4MB	\$ 149
M30 - 2MB	\$ 79
M50Z, 55sx, 65sx, 70 - 1MB	\$ 45
2MB	\$ 79
M55sx, 65sx, 70 - 4MB	\$ 135
M70-A21, A61, 121 - 2MB	\$ 79
M40sx, 35sx - 8MB	\$ 269
M57sx, 90, 95 - 4MB	\$ 135
8MB	\$ 269
M80-041 - 1MB	\$ 65
M80-111, 121, 311 - 2MB	\$ 99
M80-A21, A31 - 4MB	\$ 180
16-BIT OK Exp Board	\$ 128
32-BIT OK Exp Board	\$ 128

AST

PREM. 386/20C - 1MB KIT	\$ 65
PREM. 386/25 - 1MB	\$ 45
PREM. 486/25 - 1MB	\$ 45
PREM. II 486 - 1MB	\$ 41
4MB	\$ 139
8MB KIT	\$ 278
PREM. II 1MB Exp Board	\$ 469

COMPAQ

DP 386/20, 20E, 25 - 1MB	\$ 66
4MB	\$ 159
DP 386S/16 - 1MB	\$ 66
4MB	\$ 159
DP 286N, 386N, S/20 - 4MB	\$ 135
M-SYSTEMS - 2MB	\$ 79
4MB	\$ 135
8MB	\$ 299
DP 386/33, 486/25 - 2MB	\$ 96
SystemPro - 8MB	\$ 269
OK Exp Brd	\$ 335
DP 386S/16 1MB Exp Brd	\$ 105
DP 386/20, 20E, 25, 25E	
1MB Exp. Board	\$ 105

DELL

325D, P, 333D, P - 1MB	\$ 41
4MB	\$ 135
420, 425, 433 - 2MB KIT	\$ 82
4MB KIT	\$ 158
8MB KIT	\$ 270
450DE, 450SE - 2MB KIT	\$ 82
4MB KIT	\$ 158
8MB KIT	\$ 270

HP

Vectra QS-16 - 2MB KIT	\$ 129
4MB KIT	\$ 229
Vectra 486 - 2MB	\$ 79
4MB	\$ 135
8MB	\$ 269
X-Station 700 Ser. - 2MB	\$ 89
4MB	\$ 149
8MB	\$ 299
9000/400t, 425t - 8MB KIT	\$ 495
16MB KIT	\$ 999
32MB KIT	\$ 1869
9000/425e - 8MB KIT	\$ 428
16MB KIT	\$ 828

APPLE

II, SE, SE/30 - 1MB	\$ 32
Classic - 1MB Exp. Board	\$ 54
SE/30, IIfx, IIfx, IIfx, LC &	
Quad, 700, 900 - 4MB	\$ 115
Quad, 700, 900 - 32MB KIT	\$ 1120
IIfx - 16MB KIT	\$ 499
IIfx - 32MB KIT	\$ 1156
Quadra 256K V-RAM	\$ 27
LC 512K V-RAM	\$ 44

LAPTOPS

AST EXEC. NB - 4MB	\$ 119
COMPAQ LTE386 - 4MB	\$ 209
SLT386 - 4MB	\$ 168
DELL 316, 320 LT - 2MB	\$ 99
EVEREX TEMPO - 2MB	\$ 78
IBM L40sx - 4MB	\$ 135
MAC POWERBOOK - 2MB	\$ 104
NEC P.S. 286, 386sx - 4MB	\$ 200
P.S. 386 - 8MB	\$ 429
P.S. SX/20 - 4MB	\$ 200
PANASONIC CF170 - 1MB	\$ 55
T.I. TRVL-MT 3000 - 2MB	\$ 80
TOSHIBA 1000 - 2MB	\$ 108
2000SX - 8MB	\$ 388
3200SXC - 4MB	\$ 160
5200 - 8MB	\$ 315

PRINTERS

EPSON 6000 - 4MB	\$ 229
HP IIP, IIP, IIP, P - 2MB	\$ 108
IIfx - 4MB	\$ 135
IBM 4019, 4029e - 3.5MB	\$ 129
4029 - 4MB	\$ 135
OKIDATA 400 - 2MB	\$ 129

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

OTHER MEMORIES FOR:

ACER, ALTIMA, APPLE, AST, CHAPLET, COMPAQ, DELL, EPSON, EVEREX, HP, LEADING EDGE, IBM, NEC, NCR, OKIDATA, PACKARD-BELL, PANASONIC, PHILIP, SAMPO, SHARP, SILICON GRAPHICS, SUN MICROSYSTEMS, TANDON, TI, TOSHIBA, TULIP AND ZENITH.

CALL FOR OUR COMPLETE CATALOG

TERMS: C.O.D. CASH, VISA OR MASTERCARD.
COMPANY AND UNIVERSITY P.O.'S ACCEPTED UPON CREDIT APPROVAL.

414 CLOVERLEAF DR., UNIT B, BALDWIN PARK, CA 91706

TEL. (818)855-5688 FAX (818)855-5687



YES! I am interested in learning
more about the advantages
of TOSHIBA products.

TOSHIBA

Name _____ Title _____

Company _____ Phone _____

Address _____

City _____ City _____ Zip _____

☐ I am a Manchester Customer
my Salesperson is _____

☐ I am not yet a Manchester Customer.

☐ Have a Salesperson call right away.

☐ I am specifically interested in:

☐ Send more information on your full line
of computer supplies and equipment.



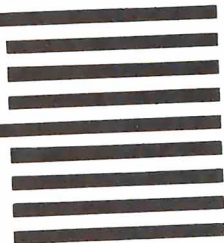
NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS MAIL PERMIT NO. 760 SMITHTOWN, N.Y.

Postage will be paid by addressee

MANCHESTER EQUIPMENT CO., INC.
50 MARCUS BOULEVARD
HAUPPAUGE, NEW YORK 11788-9909

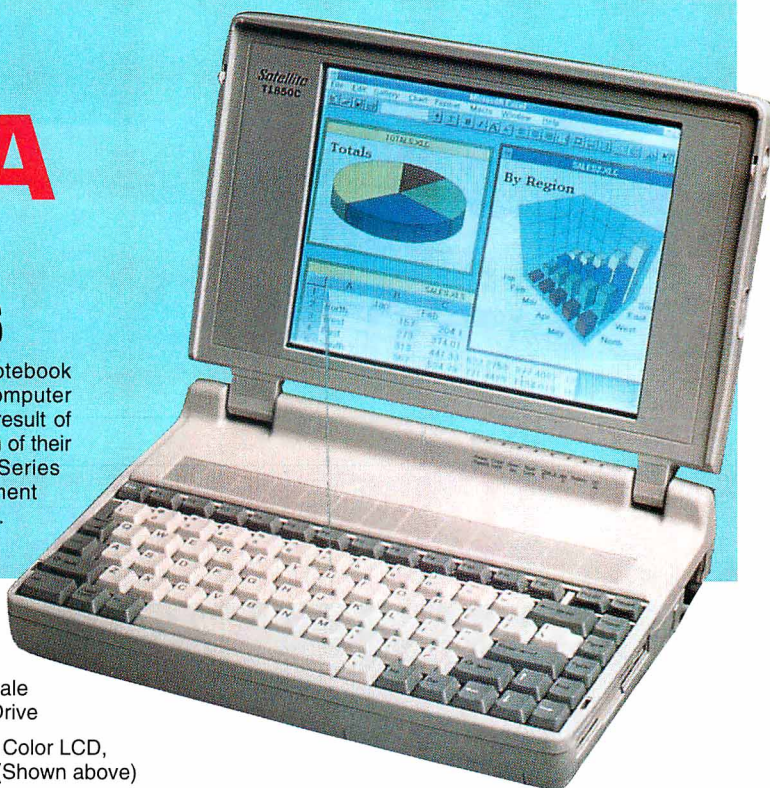




TOP OF THE LINE TOSHIBA & MANCHESTER

TOSHIBA Satellite™ T1800 SERIES

Toshiba has launched a new generation of notebook computers for the value conscious portable computer user. The economy of the Satellite Series is the result of Toshiba's expertise and the successful integration of their award-winning designs. The Satellite T1800 Series represents a secure portable computer investment because it is Toshiba designed, built, and backed... with quality and reliability second to none.



CHOOSE THE COMPUTER FOR YOUR NEEDS

T1800 i386SX/20 Processor with 9.5" Sidelit 64-Gray-Scale LCD, 2MB RAM, & 60MB Hard Drive

T1850 i386SX/25 Processor with 9.5" Sidelit 64-Gray-Scale LCD, 4MB RAM, & either 80MB or 120MB Hard Drive

T1850C i386SX/25 Processor with 9.5" Sidelit Ultra-STN Color LCD, 4MB RAM, & either 80MB or 120MB Hard Drive. (Shown above)

INCLUDED FEATURES OF THE T1800 SERIES:

- Ultra-Thin High-Resolution Screens
- Built-In 1.44MB Floppy Drive
- Ergonomic 82-Key Keyboard
- NiCad Battery Technology
- MaxTime Power Management System
- CPU Sleep Mode
- AutoResume Electric Bookmark
- AutoSave (Protects against Data loss)
- Wide Range of Accessories

SYSTEMS INTEGRATION
NETWORKING
CONNECTIVITY
RISC / UNIX
CAD / CAM

Authorized **TOSHIBA** Dealer & Service Center

MANCHESTER EQUIPMENT COMPANY, INC.

"The Computer Supply and Equipment Experts"

50 MARCUS BLVD. ■ HAUPPAUGE, NY 11788 ■ (516) 435-1199 ■ (212) 629-6677

New York City: (212) 629-6969 ■ Boca Raton: (407) 241-7900 ■ Tampa: (813) 962-8088 ■ Boston: (617) 455-8300

EISA vs LOCAL bus

Warranty...
5-year labor
2-year on USA MB
1-year standard parts

Poly 486-66E \$2500
Poly 486-66L \$2350
Poly 486-50E \$2150
Poly 486-50L \$2000
486-25SX \$990
U.S. Made Motherboards
Monitor not included

800-999-1278

TEL 415-583-7222

FAX 415-583-1974

Polywell

Computers, Inc.

61-C Airport Blvd.

So. San Francisco,

CA 94080



FREE ONE YEAR NATIONWIDE ON-SITE SERVICE



SYSTEMS INCLUDE:

- 120 Meg hard disk (14.5 ms)
- 1.44 Meg floppy drive
- 1.2 Meg floppy drive
- SVGA 1024 X 768 .28 14" color monitor
- SVGA card (trident) 1 Meg
- 220 Watt desktop or mini tower
- 2 serial, 1 parallel, 1 game, IDE 2HD/2FD
- 101-Key Enhanced keyboard
- 1 year parts and 5 years labor

- FCC B and UL Approved

386DX 40	64K Cache 4 Meg.....	1200
486DX 33	256K Cache 4 Meg.....	1600
486DX2 50	256K Cache 4 Meg.....	1650
(Limited quantity)		
486DX 50	256K Cache 4 Meg.....	1825
486DX2 66	256K Cache 4 Meg.....	1800
(Limited quantity)		

386DX OWNERS
MAKE YOUR 386DX RUN 50% FASTER
JUST CHANGE THE CPU CHIP TO A
CYRIX 486DLC 33 MHz \$225

Hours: Monday-Friday: 10am-10pm
Saturday: 10am-6pm
Sunday: Noon-6pm

P.S. Personal Solution
COMPUTERS

One Hollywood Drive
North Grafton, MA
(508) 839-3289
FAX (508) 839-6236
(800) 685-3981

Kenosha Computer Center offers some of the Best Buys in Mail Order!

Join the thousands of satisfied customers who enjoy our combination of price, service, and speed of delivery.

- No Surcharge on MasterCard or Visa!
- Kenosha Computer Center is now in its 6th year!

EPSON®

LX 810	\$169	LQ570	\$259
FX 870	\$289	LQ870	\$425
FX 1050	\$359	LQ1070	\$369
FX1170	\$389	LQ1170	\$569
EPL8000	\$1289	LQ2550	\$849
Action 3250	\$195		
150 Action Fonts	\$59		
DFX 5000 - 533 cps, 160 niq	\$1269		
DFX 8000 - 1066 cps, 160 niq	\$2139		
Call For Options			

KENOSHA COMPUTER CENTER

SALES LINE OUTSIDE WISCONSIN

1-800-255-2989

Shipping, customer service & technical assistance call
414-697-9595 • FAX 414-697-0620

VISA, MASTERCARD, AMERICAN EXPRESS ACCEPTED

TEXAS INSTRUMENTS

Travelmate 3000-WINSX	\$1749
Travelmate 4000 SX-80mg	\$2199
Travelmate 4000 WINSX 25-120	\$2349
Travelmate 4000 WINDX 120mg	\$2879
Travelmate 4000 Win SLC/25	\$1749
Travelmate 4000 Win DX2/50	\$3399
Travelmate 4000 Win SX/25 Color	\$3199
Travelmate 4000 Win DX2/40 Color	\$3899
Call For Accessories	

OKIDATA®

ML320/ML321	\$309/\$419
ML380/ML590	\$219/\$425
ML591/ML393	\$579/\$909
OL 400 Laser/OL 810	\$589/\$1029
OL 820 Laser/OL 830	\$1219/\$1279
Okilaser 400 2MG upgrade	\$119

Panasonic Office Automation

1123/1124i	\$195/\$275
2180/2123	\$179/\$229
1624/1654	\$339/\$519
2124/2624	\$299/\$359
4410/4430	\$599/\$859
4450i/4451	\$1059/\$1379
2mg. Upgrade for 4420 & 4450i	\$139

Kcc Computers

KCC 386 SX-33 w/1.2MB floppy, 2 MG RAM, 40 MG Hard Drive, SVGA Card & Monitor, DOS 5.0, Windows & Mouse	\$1249
KCC 386-DX-40 w/64K Cache 1.2 MG floppy, 4 MG RAM 106 MG Hard Drive, SVGA Card and Monitor, DOS 5.0, Windows 3.1 and Mouse	\$1499
KCC 486-DX-33 w/64K Cache, 1.2 MG floppy, 4 MG RAM, 211 MG Hard Drive, SVGA Card and Monitor, DOS 5.0, Windows 3.1 and Mouse	\$1999
All KCC systems come with a 30 day money-back guarantee. Toll-free technical support. One Year Limited Warranty.	

MEMORY PRODUCTS

2 MB IBM 30-286	\$99
2 MB IBM 55SX	\$89
1 & 4 MB SIMMS	Call
BOCA RAM AT 2 MB	\$179
4 MB TI 4000	\$229
COMPAQ LTE 386 4 MB	\$219
Toshiba, Nec, Zenith, AST, IBM, Compac, Other Manufacturers & Products	Call

LASER PRINTERS

2 MB EPSON ALII.....	\$139
2 & 4 MB H-P III	\$99/\$159
2 MB OKI 400	\$119
2 MB OKI 830/840	Call
2 MB PANA 4450i	\$129
2 MB PANA 4410/4430	\$129
Other Models & Manufacturers	Call

HOUSTON INSTRUMENTS PLOTTERS & SUMMAGRAPHICS DIGITIZERS

Image Maker A&B 11x17	\$699
DMP-52 C&D 1 Pen	\$1979
DMP-161 A to D 8 Pen	\$2749
DMP-162 A to E 8 Pen	\$3475
DMP-162R A to E 8 Pen	
Roll Feed	\$4749
Summasketch II 12x12	\$279
Summasketch II 12x18	\$479

HEWLETT-PACKARD

Laserjet IV w/toner	\$1399	Deskjet 500	\$399
Laserjet IV M w/toner	Call	Deskjet 500C	\$739
Laserjet III P w/toner	\$979	Deskjet Portable	Call
Laserjet II P+ w/toner	\$809	Laserjet III si	\$3249
1 MB Upgrade	\$69	4 MB Upgrade	\$159
2 MB Upgrade	\$99	Options	Call

Canon

BJ 10 EX	\$249	BJ 330	\$555
360 DPI, 37K Buffer, 142 CPS, 6 fonts, IBM & Epson Emulation		Wide carriage. Version of BJ 300	
BJ 20	\$365	BJC 800	\$1779
Detachable cutsheet feeder, 188 CPS, 360 DPI		Color Bubblejet, 360 DPI, 7K Buffer, Epson Emulation LQ2550, 600 CPS, Built-in auto cut sheet feeder	
BJ 300	\$339	BJ 200	\$325
600 CPS, 30K Buffer, 3 Fonts, Epson IBM Emulation		248 CPS, 360 DPI, cut sheet feed, Epson & IBM Emulation	

HARD DRIVES & TAPES SEAGATE, CONNER & MAXTOR

89 MB 3096	\$249
120 MB 3144A	\$279
211 MB 1239A	\$469
245 MB 3283	\$499
MAXTOR 200 MB 7213A	\$425
MAXTOR 340 MB 340A	\$649
CONNER 120 MB	\$279
CONNER 200	\$459

MICROSOLUTIONS

40 MB or 100 MB	\$399/\$489
External Parallel port hard drive. Perfect for Laptops, PS II's & XT's.	

HARD CARDS

Plus Hard card 50XL	\$239
Plus Hard card 105 MG	\$339

TAPE BACK UP

Colorado Jumbo 120	\$189
Colorado Jumbo 250	\$249
Colorado Tracker 120 Portable	\$339
Colorado Tracker 250 Portable	\$399
Mountain, Maynard, others	CALL

MONITORS

Mitsubishi EGA	\$239
Mitsubishi Diamond Pro 17"	\$1149
Mitsubishi HL 6955 20"	\$1779
NEC Multisync III FGX	\$619
NEC Multisync IV FGX	\$729
NEC Multisync VFGX	\$1245
NEC 6FG	\$2249
Samsung 14" Sync Master 2	\$249
Samsung 14" Sync Master 3	\$299
Samsung 15" Sync Master 15	\$479
Samsung 17" Sync Master 4	\$799

SOFTWARE

Lotus 2.4/3.1	\$329/\$379
Microsoft Word for Windows	\$299
Microsoft Windows 3.1	\$79
Microsoft DOS 5.0	\$69
PC Tools 7.1	\$79
Word Perfect 5.1	\$269
C.A. Cricket Print	\$89
C.A. SuperCalc	\$89
C.A. Simply Accounting	\$125
C.A. Clipper	\$499
C.A. BPI Value Pak	\$369
C.A. db Fast	\$345

BATTERY BACKUP & UPS AMERICAN

250/400	\$109/\$165
450/600	\$199/\$259
900/1200VX	\$375/\$729
SMART UPS 400	\$309

TRIPPLITE

BC 250	\$105
BC 400	\$159
BC 500 LAN	\$195
BC 600 LAN	\$259
BC 900 LAN	\$359

GRAPHICS CARDS

ATI VGA Wonder XL 24 1MB	\$149
ATI Graphics Ultra 1MB	\$279
ATI Graphics Ultra Pro 1MB	\$439
ATI Graphics Ultra + 1MB	\$295
Diamond Speedstar 24X w/1MB	\$175
Diamond Stealth w/1MB	\$245
Orchid Fahrenheit1280	\$269
Trident SVGA 1MB	\$79
Monochrome Boards	\$35

No charge for MasterCard or Visa. We will ship COD on a cash or cashier's check basis only. Shipping & handling 3% - \$8 minimum; AK and HI slightly higher. 15% restocking charge on returned items. Purchase orders accepted from Fortune 1000, Government institutions, schools and universities. 2% shipping discount available on orders over \$2000 if prepaid by check.

Prices and availability subject to change.

MODEMS & FAX MODEMS

PRACTICAL PERIPHERALS

PRACTICAL PER 2400 INT/EXT	\$69/\$99
PRACTICAL PER 9600 INT/EXT	\$199/\$229
PRACTICAL PER 14.4 INT/EXT	\$329/\$355

HAYES

HAYES OPTIMA 9600	\$329
HAYES OPTIMA 14.4	\$399
HAYES OPTIMA 14.4 W/FAX	\$439
HAYES ULTRA 14.4	\$619

U.S. ROBOTICS

USR 9600 V.32 bis	\$539
HST 16.9 Int/Ext	\$499/\$549
USR SPORTSTER 14.4 Int/Ext	\$309/\$309
USR SPORTSTER 14.4 W/FAX	\$328
USR DUAL STD EXT	\$729
World Port 96/96 Fax Modem	\$439
Intel Satisfactions Below	

intel

Satisfaction Fax Modems

100 2400/9600 Fax	\$99
200 2400 V.42/9600 Fax	\$275
400 14.4/14.4 Fax	\$375
400 ext 14.4/14.4 Fax	\$419
Faxability Plus	\$59
80387-SX co-processor	\$75
80387-DX co-processor	\$85
Overdrive Processor Upgrade	Call

MULTIMEDIA & CD ROMS

Magnavoc 461 RS EXT w/software	\$389
Soundblaster Pro	\$189
Videoblaster	\$339
Imports video & audio from VCRs, cameras and video discs into VGA graphics	
Soundblaster Pro Multimedia Upgrade kit	\$539
With Soundblaster Pro, midi kit, CD Rom drive & software	
NEC CDR 74 w/gallery	\$629
NEC CD Express	\$419

NETWORKING

NETWARE 2.2 5 USER	\$499
NETWARE 2.2 10 USER	\$1099
NETWARE 2.2 50 USER	\$2099
NETWARE 3.11 5 USER	\$589
NETWARE 3.11 10 USER	\$1359
NETWARE 3.11 50 USER	\$2699
NE 2000	\$139
LANTASTIC 10MPS STARTER KIT	\$449
LANTASTIC 10MPS ADAPTER	\$199
LANTASTIC FOR WINDOWS	\$165
3 COM ETHERLINK II	\$185
3 COM ETHERCARD	\$279
INTEL ETHER 16	\$119
INTEL ETHER 16 20 PAK	\$1975
SMC ETHER + ELITE 16	\$145
SMC ETHERNET 8 BIT COAX	\$95
XIRCOM POCKET ADAP COAX	\$299
XIRCOM POCKET ADAP 10 BASE T	\$299

KENOSHA COMPUTER CENTER

2133 91st Street
Kenosha, Wisconsin 53140

1-800-255-2989

KENOSHA COMPUTER CENTER

Enter The Ultimate Performance Zone!

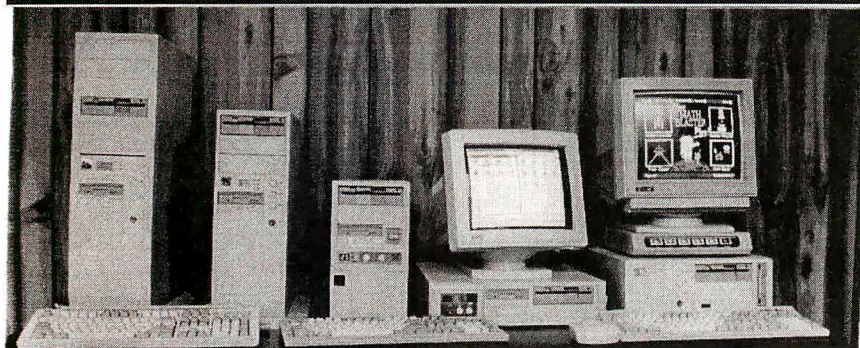
With Computers

1-800-755-7518

3129 Main Street Weirton WV 26062

SYSTEM	BASIC SYSTEM	BASIC 40 MB HD + Card & Monitor	BASIC 80 MB HD + Card & Monitor	BASIC 170 MB HD + Card & Monitor	BASIC 210 MB HD + Card & Monitor	BASIC 340 MB HD + Card & Monitor
486-50 EISA	\$1,099	\$1,499	\$1,569	\$1,659	\$1,739	\$1,939
486-33 EISA	\$839	\$1,239	\$1,309	\$1,399	\$1,479	\$1,679
486-66 DX2	\$979	\$1,379	\$1,449	\$1,539	\$1,619	\$1,819
486-50 Local Bus	\$949	\$1,349	\$1,419	\$1,509	\$1,589	\$1,789
486-33 Local Bus	\$719	\$1,119	\$1,189	\$1,279	\$1,359	\$1,559
486-50 ISA	\$919	\$1,319	\$1,389	\$1,479	\$1,559	\$1,759
486-33 ISA	\$689	\$1,089	\$1,159	\$1,249	\$1,329	\$1,529
486-25 SX	\$439	\$839	\$908	\$999	\$1,079	\$1,279
386-33/40	\$399	\$749	\$869	\$959	\$1,039	\$1,239
386-33SX	\$309	\$700	\$779	\$869	\$949	\$1,149

Basic Systems Include : ~ Motherboard & CPU ~ 101 Enhanced Keyboard ~
1.2 Meg or 1.44 Meg Floppy Drive ~ 2 Hard/2 Floppy IDE Controller ~
~ 2 Serial/1 Parallel/1 Game Ports ~ Internal Clock Calendar ~ Coprocessor Socket ~



PRINTERS	
HP IV	\$ 1450
HP IIIP	1010
DESKJET 500	395
DESKJET 500C	639
KXP 1180I	159
KXP 1123	199
KXP 4410	639
KXP 2123	239
NEC P85	1429

VIDEO CARDS	
Mono Card w/Printer Port	\$ 11
VGA 256K (800X600 16bit)	29
1Mb VGA (1280X1024)	59
Speedstar Plus 1Mb (1024X768)	104
Speedstar 24X (1024X768)	165
Speedstar Stealth VRAM	235
ATI Ultra 1MEG	269
S-3 EISA	229
E-T4000 Local Bus	145

MOTHERBOARDS	
386SX-33	\$ 112
386DX-33 64K Cache	169
386DX-40 64K Cache	186
486SX-25 8K Cache	230
486DX-33 ISA 256K Cache	475
486DX-50 ISA 256K Cache	701
486-DX2-66 ISA 64K Cache	759
486DX-50 EISA 256K Cache	889
486DX-66 EISA 256K Cache	940
486DX-33 Local Bus 256K Cache	610
486DX-50 Local Bus 256K Cache	729
486DX-66 Local Bus 256K Cache	765

TAPE BACK-UPS	
120Mb Colorado Tape Back-Up	\$ 189
250 Mb Colorado Tape Back-Up	285
QIC 40 TAPE	32
QIC 80 TAPE	35

MONITORS	
14" Mono Monitor	\$ 104
14" Mono VGA	120
14" SVGA (1024X768 .39)	227
14" SVGA (1024X768 .28)	270
14" SVGA (1024X768 .28) NI	306
14" Sony 1304	599
15" MAG	575
15" NEC 3F6X	649
17" SVGA NI	650
17" SONY 1604	1039

NETWORKING	
NOVELL V3.11 5 USER	\$659
NOVELL V3.11 10 USER	1499
NOVELL V3.11 20 USER	1996
NOVELL V3.11 100 USER	4249
ARCNET 8/16 (STAR)	40/89
ARCNET 8/16 (BUS)	64/94
ACTIVE HUB 4/8 PORTS	79/139
NE-1000 COMPAT (COAX/TP)	90/110
NE-2000 COMPAT (COAX/TP)	100/130

MEMORY	
1 MEG X 9 70 NS SIMM	\$ 37
256K X 9 70 NS SIMM	12
4 MEG X 9 70 NS SIMM	143

IIT CO-PROCESSORS	
387SX-25	\$ 65
387DX-25	69
387DX-33	75
387DX-40	90

SCANNERS	
HP SCANJET 2P	\$ 890
HP SCANJET 2C	1645

MODEMS	
2400B Modem	\$ 39
9600B SEND/RECEIVE FAX	79
9600B w/V.32 & V.42 BIS	229

CASES W/POW'R SUPPLY	
Mini Tower 200W Digital	\$ 49
Mini Desk 200W	69
PS2 Style 200W	78
MidTower 200W Digital w/7 Bays	89
FullTower 230W w/11 Bays	117

NOTE BOOKS	
386-285X 60 MEG HD - 1.44 FD	
1 MEG RAM VGA LCD SCREEN	
BATTERY - CARRYING CASE	\$1199

FLOPPY/HARD DRIVES

1.2/1.44 Mb FD	\$ 52
40 Mb/28 ms IDE	149
30 Mb/18 ms IDE	209
105 Mb/17 ms IDE	236
170 Mb/15 ms IDE	289
210 Mb/15 ms IDE	372
340 Mb/12 ms IDE	678
535 Mb/16 ms IDE	1019
210 Mb/16 ms SCSI	469
340 Mb/16 ms SCSI	732

KEYBOARDS

101 ENHANCED	\$ 25
101 LITE-ON CLICK	36
108 FOCUS 2001	40
111 FOCUS 8000	79
130 FOCUS 9000	79
MOUSE	13

CONTROLLERS

IDE 2FD/2HD	\$ 12
IDE 4FD/2HD	29
IDE 2FD/2HD w/2S/1P/1G	20
AT I/O 2S/1G	15
RLL 2FD/2HD 1:1	40
MFM 2FD/2HD 1:1	40
Ultrastor 12F ESDI 32k Cache (ISA)	189
Ultrastor 14F SCSI 64K Cache (ISA)	239
Ultrastor 24F	449
Ultrastor 22F/22C ESDI (EISA)	489/639
Ultrastor 15C IDE Cache (ISA)	199

CD ROMS/MULTIMEDIA

CD ROMS/MULTIMEDIA	
MITSUMI CRMC	\$ 179
NEC CDR84	529
MULTIMEDIA KIT	619
SOUNDBLASTER	99
SOUNDBLASTER PRO	199

Why Ulta

Satisfied Government & Corporate Customers ~
- Pentagon
- General Electric
- Mellon Bank
- Sigma SoftWare

No hassle return Policy
Name brand Parts
- Teac
- Sanyo
- Intel
- NEC

Knowledgeable Sales and Technical Personnel

1 Yr. Parts & 5 Yr. Service Warranty

On-site Service Warranty Available

48 Total System Burn-in

Peace of mind knowing the Quality and Reliability That only a Ulta Computer Can Bring.

Manufactured Direct to you Right here in the United States

Prices subject to change without notice. All returns subject to 15% restocking fee and must be accompanied by a RMA number within 30 days. Shipping, Insurance & COD charges are extra an non-refundable. All prices reflect a 3% discount for cash. Ulta Computers is not responsible for Typographical or Photographical errors. \$3.00 charge for orders under \$100.00.

HOME IS WHERE THE HEART STOPS.

MOVING CAN BE SUCH A HARROWING EXPERIENCE. ESPECIALLY WHEN YOU'RE THE SOLE INHERITOR OF THE BLOODCURDLING WINTHROP HOUSE.

LUCKY YOU. FOR THE PAST 400 YEARS, YOUR EVIL ANCESTORS HAVE BEEN PLANNING A HOUSEWARMING PARTY JUST FOR YOU. AND IF THEY HAVE IT THEIR WAY, THIS IS ONE PARTY YOU WON'T BE LEAVING.



IN THIS PIECE OF UNREAL ESTATE, YOU'LL EXPLORE UP TO 400 TERROR-RIDDEN ROOMS IN A DESPERATE STRUGGLE TO STAY ALIVE. YOU'LL ENCOUNTER PUZZLES, MAGICAL ITEMS, AND FORBIDDEN BOOKS. AND YOU'LL MEET THE HIDEOUS HOSTS WHO KNOW WHAT EVIL FORCES ARE BEHIND THIS NIGHTMARE.

CAN YOU TAKE THE TENSION? WILL YOUR MAGIC COMBAT SKILLS WORK AGAINST LOATHSOME GARGOYLES OR DEATH LEECHES?



Actual Screen Shots May Vary

WILL YOUR NEW HOUSE DRIVE YOU COMPLETELY INSANE?



ALL YOU KNOW IS THAT TIME IS RUNNING OUT. THE HEAVENS ARE ALIGNING. AND THERE'S A LOT OF HOUSECLEANING TO BE DONE.

THE LEGACY: REALM OF TERROR™ FROM MICROPROSE. PROOF THAT THERE'S NO PLACE LIKE HOME. AT LEAST NOT IN THIS WORLD.

SPINE-TINGLING GRAPHICS WILL TURN YOU CHALK-WHITE WITH **HORROR!**

HAIR-RAISING COMBAT WITH **GROTESQUE CREATURES!**

STUPEFYING STUMPERS IN **SURREAL ROOMS!**

To get our free catalog, call **1-800-879-PLAY.**
(Mon.- Fri., 8:30 am-5:00 pm EST.)

Or fill out the coupon and mail it to: MicroProse Software, Inc.
180 Lakefront Drive • Dept. D-10 • Hunt Valley, MD 21030-2245

Name _____

Address _____

City _____ State _____ Zip _____

NAF

MICROPROSE™
ENTERTAINMENT • SOFTWARE
SERIOUSLY FUN SOFTWARE

© 1992 MicroProse Software, Inc. ALL RIGHTS RESERVED.

MEMORY... YOU JUST CAN'T DO WITHOUT IT.

Picture this:

You bought a new software package. You try it out on your computer and soon find yourself working for hours on a sophisticated graphic design. While scrolling through your worksheet, it feels like you are moving through pudding. Your hard disk has a tough time trying to catch up. You then try to print, but the laser printer's buffer is full. You reset it, try again, and find that it spits out only part of your beautiful graphic....

No problem!

We'll take it from here. With our **JetRam™** line that supports the leading brands of laser printers and **PcRam™** line that upgrades your Notebook, Laptop or Desktop computers, Transcend can help solve your memory problems.

What you get from our memory upgrades

- Life time warranty on all our products
- Full memory lines support a variety of brand names of laser printers and PCs
- High quality at a reasonable price
- Easy-to-install

Office hours: 6:00 a.m. to 6:00 p.m. Mon. to Fri.

"You order in the morning, we will ship in the afternoon."



* All brand names are registered trademarks of their respective owners.

Transcend

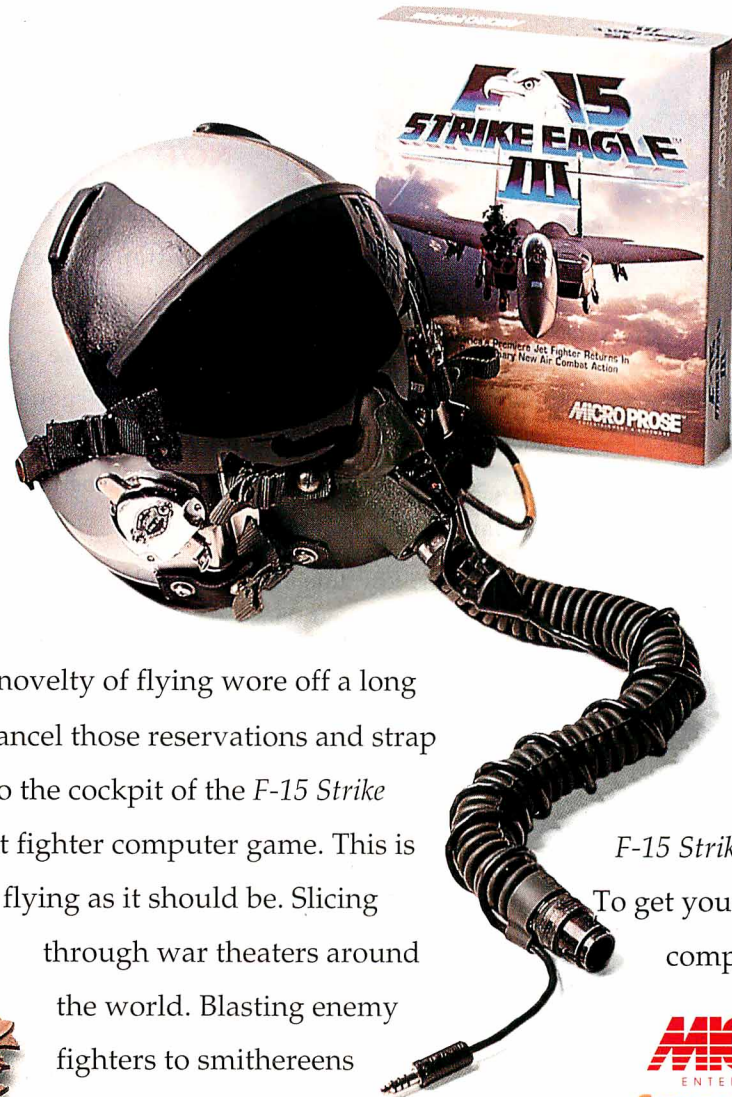
*Your Supplier, Your Partner,
Your Friend.*

Transcend Information Inc.

104 Exchange Place,
Pomona, CA 91768 U.S.A.
TEL: (909) 598-5500
FAX: (909) 598-5050, (909) 598-6050

3Fl., No. 465, Chung Hsiao East Road,
Sec. 6, Taipei, Taiwan, R.O.C.
TEL: (886) 2-7881000
FAX: (886) 2-7881919, 7889191

THIS IS ONE FLIGHT YOU DEFINITELY WON'T BE SLEEPING THROUGH.



So the novelty of flying wore off a long time ago. Cancel those reservations and strap yourself into the cockpit of the *F-15 Strike Eagle® III* jet fighter computer game. This is



flying as it should be. Slicing through war theaters around the world. Blasting enemy fighters to smithereens with high-tech missiles.

Devastating strategic targets in dangerous bombing runs. Performing fantastic aerial aerobics. And dogfighting against a friend via modem. All brought to life by dazzling, state-of-the-art graphics. Sure, it's not like flying first class.



But when's the last time you had fun flying first class?

F-15 Strike Eagle III from MicroProse.

To get your copy, visit your favorite computer game retailer today.

MICRO PROSE™
ENTERTAINMENT • SOFTWARE
SERIOUSLY FUN SOFTWARE

To get our free catalog, call **1-800-879-PLAY** (Mon. - Fri., 8:30 am - 5:00 pm EST) or fill out the coupon and mail it to: MicroProse Software, Inc. 180 Lakefront Drive Dept. D10 • Hunt Valley, MD 21030-2245

Name _____
Address _____
City _____ State _____ Zip _____
Telephone () _____

NAH

© 1992 MicroProse Software, Inc. ALL RIGHTS RESERVED.
Available for IBM-PC/Compatibles.

REX NEBULAR IS FOR HIRE!

AND THE SPACEWAYS WILL NEVER BE THE SAME!

Sure, he's for hire. But if he doesn't pull off this job, Rex Nebular's reputation as an interstellar adventurer and womanizer will take a bruising. If that's still possible.

All he has to do is retrieve a priceless vase for a really ticked-off Colonel Stone. It should be easy... **NOT!**

Especially when this Cosmic Gender Bender gig has enough traps to send Rex to his grave a thousand times over.

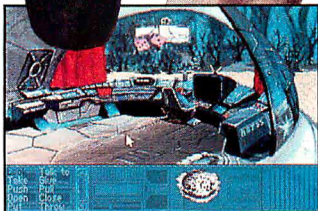
Rex will have to locate a cloaked planet. Survive the grotesque Gender Bender machine. Negotiate the perils of a vast underwater world. And tear himself away from legions of sex-starved aliens. Some of whom would like nothing better than to use our hero as breeding stock!

And Rex thought women only wanted him for his mind!

Save Rex Nebular from himself. And save the universe from Rex Nebular. Get your copy of *Rex Nebular And The Cosmic Gender Bender* today at your favorite retailer.



Actual screens may vary.



• **STIMULATING** state-of-the-art graphics and animation!

• Thousands of **MIND-BENDING PUZZLES TO UNLOCK!**

• **TITILLATING** rotoscoped art!

• **EASY, HARD, and ADVANCED** modes!

• **AROUSING INTUITIVE INTERFACE** light years ahead of any other!

To get our free catalog, call **1-800-879-PLAY**.
(Mon.- Fri., 8:30 am-5:00 pm EST.)

Or fill out the coupon and mail it to: MicroProse Software, Inc.
180 Lakefront Drive • Dept. D-10 • Hunt Valley, MD 21030-2245

Name _____

Address _____

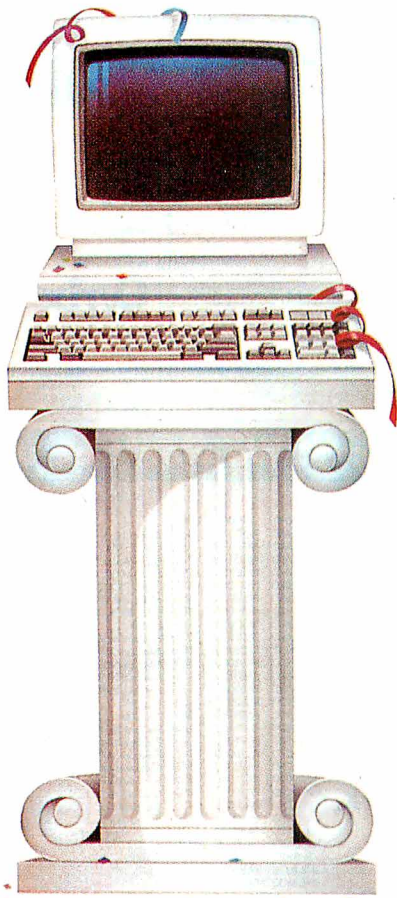
City _____ State _____ Zip _____

Telephone () _____

NAG

MICRO PROSE™
ENTERTAINMENT • SOFTWARE
SERIOUSLY FUN SOFTWARE

© 1992 MicroProse Software, Inc. ALL RIGHTS RESERVED.



Everyone makes claims. We make sure.

When the industry wants product testing taken to the nth degree, they take it to NSTL.

In every field, one name sets the standard. In microcomputer testing, the name is NSTL, the leading independent testing lab.

The NSTL compatibility certification seal on a product says that it withstood the toughest lab in the industry — and it's ready for your business.

The seal saves you a lot of comparison and guesswork. It says you'll find the product compatible with a wide range of business applications and hardware. It helps you make the right choice.

Real-world testing for real-world use.

Beyond compatibility testing, we access nearly every conceivable

problem — from engineering-level hardware bugs to the everyday usability of business software.

And we test with the end-user in mind, in a real-world environment, just the way your staff uses equipment. Except our trials are more punishing.

Our publications, and others that publish our work.

In a separate facility we also do comparison testing for our own Ratings Reports: *Software Digest*®, *PC Digest*® and *LAN Reporter*®. They're read by people who purchase an average of more than \$500,000 in microcomputer hardware and software annually.

And because of the respect we've earned, some of the industry's leading publications, like *Data Communications*,

LAN Times, *Unix World* and *Datapro Research Group* publish our test results.

Look for the NSTL seal and be sure.

Experts rely on the NSTL name: now you can, too. The final test of a product is its compatibility in a business environment. The NSTL mark tells you it's already met that test. Look for it when you compare products.

NSTL

Plymouth Corporate Center
Box 1000, Plymouth Meeting, PA 19462
215-941-9600

Micro Channel™ and OS/2™ are trademarks of the IBM Corporation.



Original IBM PS2

1200 baud Modem for Micro Channel:
List \$149.00 Your Price \$7.75

Seagate ST4766N

CS51 600MB, 15MS, 5 1/4" FH.
Only \$899.00 while supplies last

16 Bit Memory Board

Hardware EMS 4.0 W/Multitasking - 5 YR WARRANTY
2MEG \$129 8MEG \$352 16MEG \$653

SOFTWARE LIQUIDATION

WORDSTAR

Wordstar 6.0 or Wordstar 2000 Rel. 3.5

This is not a misprint! These are the exact same ones selling for over \$300.00 from our competitors.

We have thousands in stock
FOR SALE BELOW DISTRIBUTOR COST!

UST \$495.00 ea

DEALERS WELCOME
RETAIL BOXED & FACTORY SEALED

7.0 Upgrade \$89

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

\$99

COMPUTER PERIPHERALS, INC.

Modems

2400 Internal, V.22 for IBMPC, XT, AT and compatibles, CCITT V.22bis, V.22 and Bell 212A. Auto dial/answer. Supports Comm 1-4/IR0 3,4,5 or 7. Hayes AT Commands. \$39

2400 External, same as above plus 8 LED status lights, requires serial port, \$69

HIGH SPEED FAX MODEM

14.4K bps, V32bis, Internal \$239

BOCA 2400 Internal

V.22bis w/MNP/PS, only \$89

FAX MODEM 9600bps Fax, 2400bps modem, Data Fax Auto

Sensing, Comm 1-4/IR0 3,4,5 or 7, Hayes AT Commands, Mirror

Software, Full or half Duplex, Pulse or Tone \$68



intel CPU's

8086SX/16 \$29 8086DX \$35

8086SX/20 \$39 8086DX/20 \$49

8086SX/25 \$49 8086DX/25 \$59

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086SX/33 \$59 8086DX/33 \$69

8086DX/SX

8086DX/25 \$345

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

8086DX/33 \$399

PRINTER SHARING SOLUTIONS

EASY INSTALLATION AND OPERATION

Standard parallel interfaces make installation simple, and since the HWP supports both software and push-button control, it is easy and convenient to use.

FAST DATA TRANSFER

The HWP transfers data at speeds up to 180,000 characters per second. It can buffer large jobs sent from your PC faster than your printer can print them. Your PC can go on to the next task, whether or not a printer is available to it.

AUTOMATIC FUNCTIONS

Input switching and buffering are automatic, so with the HWP installed all your PCs print quickly and easily.

LARGE BUFFER CAPACITY

Buffalo H Series boxes offer buffer expandability from 256 KB up to 16MB to handle even the largest graphics projects.

OTHER ALTERNATIVES

Buffalo carries a complete line of computer resource sharing products, priced from \$175.



HWP256 \$295

Circle 168 on Inquiry Card.

TOLL-FREE TECHNICAL SUPPORT

Buffalo Technical Support provides friendly, effective assistance for installation and operation.

TOLL-FREE APPLICATION ADVICE

Our knowledgeable staff will help you select the right Buffalo Products, Inc. products to fit your needs.

ONE YEAR WARRANTY

45 DAY MONEY-BACK GUARANTEE

BUFFALO®

US AND CANADA TOLL-FREE

1-800-345-2356

(503) 585-3414

FAX (503) 585-4505

Buffalo Products, Inc.

2805 19th St. SE, Salem, OR 97302

Response Code: 23HW3

BUFFALO is a registered trademark of Melco, Inc.

International Distribution

FAX 81-45-641-5417

You Can Rely on Ralin For all Your PC System Upgrades!

MODEM UPGRADES

Zoom Telephonics

All Zoom modems are backed by a 7-year warranty and are made in the USA.



2400 bps w/ v.42bis and MNP 2-5	(AMC) (AMX)	internal external	\$ 49.00 \$ 65.00
2400 bps w/ v.42bis and MNP 2-5 9600 send & 4800 receive Fax	(AFC) (AFX)	internal external	\$ 59.95 \$ 79.95
9600 bps modem w/ v.32, v.42bis, MNP2-5	(VP-V32) (VX-V32)	internal external	\$199.00 \$199.00
14,400 bps modem w/ v.32bis, v.32, v.42bis, MNP 2-5 and 9600 bps send/receive Fax	(VFP-V32bis*) (VFX-V32bis*)	internal external	\$229.00 \$269.00
2400 bps modem w/ 42 bis and MNP 2-5, 9600 bps send and 4800 bps receive Fax	PKT Pocket/Fax Modem		\$ 99.00

*WINFAX software option available for \$15 if purchased with VFP-V32bis or VFX-V32bis modem.

Call a corporate sales expert today and find out how Ralin can maximize your purchasing dollars by upgrading your existing computer equipment.

Ralin stocks: • Motherboards • SIMM Memory • Controllers • Printers • Monitors
Hard Drives • MPC Products • Computer Cases • Keyboards and much more

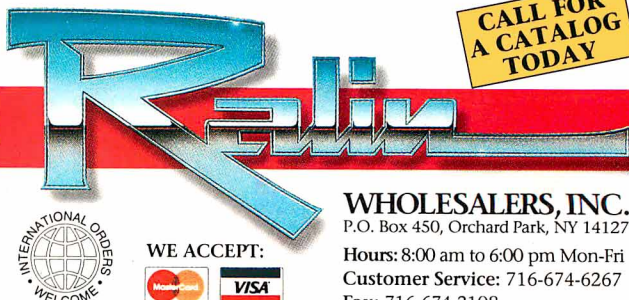
CALL 1-800-752-9512

Ralin Policies

- Prices and availability subject to change.
- Purchase orders are accepted, subject to approval.
- We do not charge your card until order is processed.

- Incomplete returns are subject to a service charge.
- All returns other than exchanged items incur a 10% re-stocking fee.

To insure your shipment arrives when you need it, Ralin uses only the most reputable modes of transportation available:



WE ACCEPT:



WHOLESALE, INC.

P.O. Box 450, Orchard Park, NY 14127

Hours: 8:00 am to 6:00 pm Mon-Fri

Customer Service: 716-674-6267

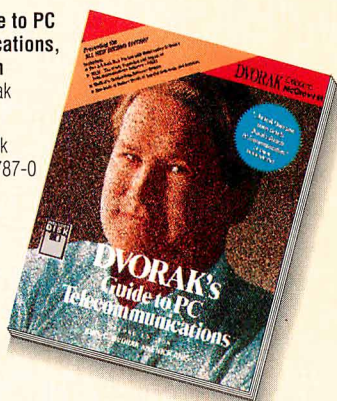
Fax: 716-674-2108

HOT

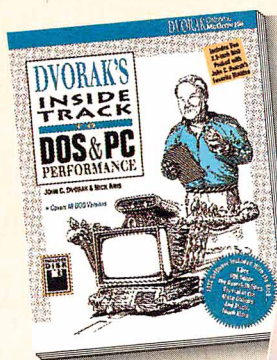
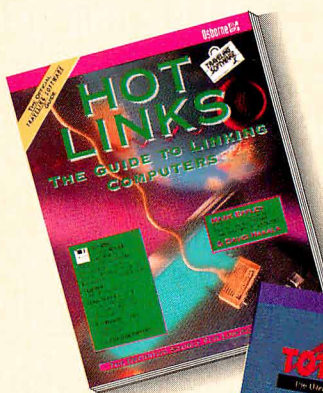
...Topics of Conversation

For Today's Hottest Authors on the Hottest Topics, Choose Osborne Computer Books

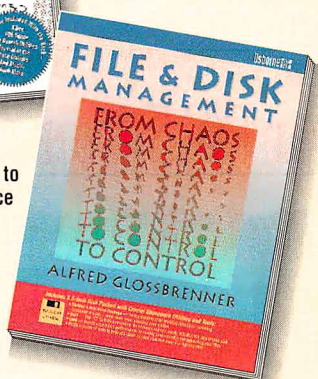
Dvorak's Guide to PC Telecommunications, Second Edition
by John C. Dvorak and Nick Anis
\$39.95 Book/Disk
ISBN: 0-07-881787-0



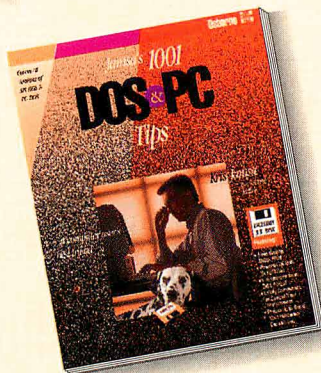
Hot Links: A Guide to Linking Computers
by Mark Eppley and David Hakala
\$29.95 Book/Disk
ISBN: 0-07-881020-5



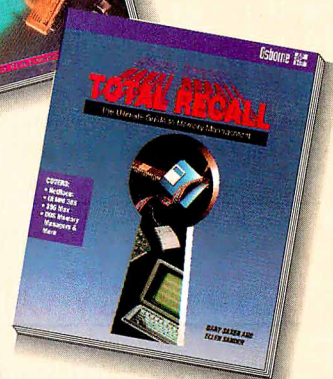
Dvorak's Inside Track to DOS & PC Performance
by John C. Dvorak and Nick Anis
\$39.95 Book/Disk
ISBN: 0-07-881759-5



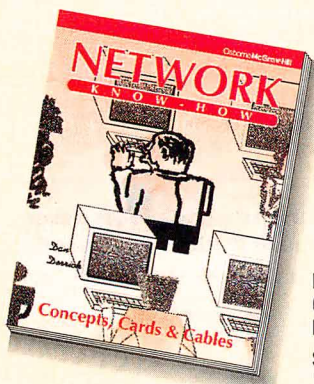
File & Disk Management: From Chaos to Control
by Alfred Glossbrenner
\$39.95 Book/Disk
ISBN: 0-07-881834-6



Jamsa's 1001 DOS & PC Tips
by Kris Jamsa
\$39.95 Book/Disk
ISBN: 0-07-881821-4



Total Recall: The Ultimate Guide to Memory Management
by Gary Saxer and Ellen Sanders
\$19.95
ISBN: 0-07-881835-4



NetWork Know-How: Concepts, Cards, & Cables
by Dan Derrick
\$19.95
ISBN: 0-07-881833-8

Get the inside scoop on the best ways to maximize your computer's performance from Osborne's top authors. You'll find practical, real-world discussions in these books along with exclusive tips and insights. PLUS, in the book/disk packages, you'll also find software that is **new** and **unavailable** elsewhere.

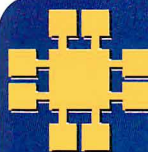
AVAILABLE NOW AT THE FOLLOWING STORES

If you paid full price, you didn't buy it at
CROWN BOOKS **Waldensoftware®**
SUPER CROWN **Waldenbooks®**
Three times more books. Same great Crown prices.

Osborne

Copyright © 1993 McGraw-Hill, Inc.

SOFTWARE ETC.



JDR Microdevices®

2233 Samaritan Drive, San Jose, CA 95124

Serving you since 1979

BUY WITH CONFIDENCE FROM JDR!

- 30-DAY MONEY BACK GUARANTEE
- 1 YEAR WARRANTY
- TOLL-FREE TECH SUPPORT



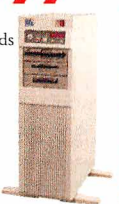
UPRIGHT CASE

\$99⁹⁵

- Mounts 3 floppy and 4 hard drives
- Accommodates std. & mini motherboards
- 2 digit LED display

CASE-100A	.....	\$99.95
CASE-200A Super Deluxe Upright	.....	\$349.95
PS-250TW 250W p. supply	.....	\$129.95
PS-300TW 300W p. supply	.....	\$149.95
CASE-130 Mid-upright case	.....	\$99.95
CASE-120	.....	\$199.95

Mini-upright case w/200W power supply



POWER SUPPLIES

- U/L approved
- 110/220VAC, 50/60Hz

PS-150 8088 150 watt	.....	\$69.95
PS-200X 8088 200 watt	.....	\$89.95
PS-200 286/386/486 200 watt	.....	\$89.95
PS-300 286/386/486 300 watt	.....	\$149.95



ENHANCED KEYBOARD

\$49⁹⁵



BTC-5339 101/102-key enhanced layout \$49.95

NON-INTERLACED 1024 x 768 MONITOR

VGA-MON-1024N .28 dot pitch \$389.95

VGA-MON-1024 1024x768 int. monitor, .28mm	.....	\$349.95
VGA-PKG-1024N Non-interlaced Super VGA pkg	.....	\$499.95
VGA-PKG-1024+ 1024x768 interlaced Super VGA pkg.	.....	\$469.95
VGA-PKG 640x480 .39mm dot pitch VGA pkg.	.....	\$349.95

2400 BAUD MODEM

\$49⁹⁵

- Internal data modem
- Hayes compatible
- Config. as COM1-COM2

MCT-241 \$49.95



14,400 BPS INTERNAL FAX/MODEM

- 14,400/12,000/9600/7200/4800/2400/300
- Hayes AT set, V.42bis/V.42/V.32, Group III fax comp.

VIVA-144IF	.....	\$269.95
VIVA-144EF 14,400 baud external version	.....	\$349.95
VIVA-96E 9600 baud external modem only	.....	\$299.95

FAX/MODEM/PHONE SWITCH

- Save phone line charges!
- Supports fax, modem, phone and answering machine from 1 phone line

FAXM-SWITCH \$89.95

FAX-SWITCH Without modem connection \$59.95



PORTABLE IC TESTER

- Tests the following 14 to 20-pin devices: 74 series TTL, 40 & 45 series CMOS & 41/44 series DRAM up to 1Mb
- Identifies unknown part numbers

MOD-HIC \$149.95



WIRE-WRAP PROTOTYPE CARDS

JDR-PR2 8-bit with I/O decode layout	.....	\$29.95
JDR-PR10 16-bit with I/O decode layout	.....	\$34.95

SOLDERLESS PROTOTYPE CARDS

PDS-601 8-bit breadboard-on-a-card w/I/O decode	.....	\$79.95
PDS-611 16-bit version	.....	\$89.95

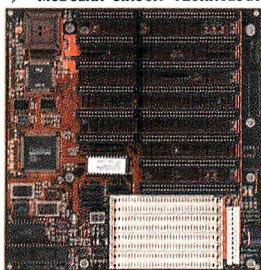
MOTHERBOARDS

MODULAR CIRCUIT TECHNOLOGY

25MHZ 386SX

\$199⁹⁵

NEW LOWER PRICE!



- 25MHz Intel 80386SX CPU
- Expandable to 16Mb on-board
- Uses 256K, 1M or 4M x 90ns SIMMs (OK installed)
- Six 16-bit and two 8-bit slots

MCT-M386SX-25	.....	\$199.95
MCT-M486-50E 50MHz EISA w/cache	.....	\$1395.00
MCT-M486-50 50MHz cache 486	.....	\$999.00
MCT-M486-33 33MHz cache 486	.....	\$799.00
MCT-M486SX-25 25MHz cache 486SX	.....	\$399.95
MCT-C386-40 40MHz cache 386	.....	\$379.95
MCT-C386-33 33MHz cache 386	.....	\$349.95
MCT-M286-16 16MHz 286	.....	\$149.95
MCT-M286-12 12MHz 286	.....	\$129.95

16-BIT VGA CARD

\$49⁹⁵

- 8/16-bit 8088 and 286/386/486 compatible
- 640 x 480 in 16 colors 320 x 200 in 256 colors
- 256Kb video RAM

MCT-VGA-1000	.....	\$49.95
MCT-VGA-4000 1024x768, 1Mb DRAM	.....	\$129.95
MCT-VGA-5000 Windows Accelerator	.....	\$149.95
SPEEDSTAR-24X 24-bit color, 1280x1024	.....	\$199.95
STEALTH-VRAM Windows accel., 1280x1024	.....	\$249.95



3-BUTTON MOUSE

\$14⁹⁵

- Accuracy 290 -1450 DPI
- Opto-mechanical design
- Windows 3.1 compatible

JDR-MOUSE-3 \$14.95

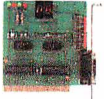
MOUSE-PAD \$4.95



POST CODE DISPLAY CARD

- 286/386/486 compatible
- Displays power on self-test code
- Works when software won't even boot

PCODE \$49.95

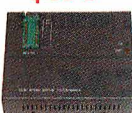


EPROM PROGRAMMER

\$199⁹⁵

- Programs devices up to 512K bits, plus 27C100, 27C101, 27C301, 27C1000, 27C1001, 27C2001, 27C4001 and more
- Includes dedicated 8-bit 8088 and 286/386/486 PC compatible card
- ZIF socket accepts 0.6"W DIP IC's to 32 pins

MOD-MEP-1A	.....	\$199.95
MOD-MEP-4A As above with 4 ZIF sockets	.....	\$269.95
MOD-EMUP Universal programmer/tester	.....	\$699.00



EPROM ERASER

\$39⁹⁵

- Quickly and simultaneously erases up to 4 standard EPROMs

DATASE II \$39.95



CONNER 84Mb DRIVE PACKAGE

\$259

- CP-30084 84Mb, 19ms IDE hard drive, 16-bit floppy/hard disk controller, cables and instructions

HDKIT80 \$259.00



IDE HARD DRIVES

PART #	BRAND	CAP.	SPD.	TYPE	PRICE
CP-3000	Conner	42Mb	28ms	3.5" IDE	\$189
ST-351A	Seagate	42Mb	28ms	3.5" IDE	\$179
CP-30084	Conner	84Mb	19ms	3.5" IDE	\$239
ST-3096A	Seagate	88Mb	16ms	3.5" IDE	\$259
CP-30104	Conner	120Mb	19ms	3.5" IDE	\$319
ST-3144A	Seagate	131Mb	16ms	3.5" IDE	\$319
CP-30204	Conner	212Mb	12ms	3.5" IDE	\$479

FLOPPY DRIVES

FDD-1.44A 1.44Mb, 3.5", Beige	.....	\$79.95
FDD-1.44X 1.44Mb, 3.5", Black	.....	\$79.95
FDD-1.2 1.2Mb, 5.25", Beige	.....	\$89.95
FDD-360 360Kb, 5.25", Black	.....	\$89.95
FDD-2.88A 2.88Mb 3.5" drive, Beige	.....	\$149.95
FD-505 5.25" & 3.5" combo drive, Beige	.....	\$149.95



MULTI I/O CARD WITH IDE FLOPPY/HARD CONTROL

\$69⁹⁵

- 16-bit 286/386/486 compatible
- Supports 2 IDE hard drives & 2 floppy drives (360Kb-1.44Mb)
- 2 serial, 1 parallel & 1 game port



MCT-IDEIO	.....	\$69.95
MCT-IDEIO+ As above w/16550 compatibility	.....	\$99.95
MCT-IDEFH 16-bit IDE hard/floppy controller	.....	\$29.95
MCT-CIDEFH 16-bit IDE CACHE controller	.....	\$169.95
MCT-IDE-8 8-bit IDE controller	.....	\$79.95
MCT-FDC-HD 1.44Mb floppy controller	.....	\$49.95
MCT-FDC-HD4 1.44Mb floppy controller (4 drives)	.....	\$59.95
MCT-FDC-ED 2.88Mb intelligent floppy controller	.....	\$79.95
MCT-AIO Serial/parallel/game port card	.....	\$49.95
MCT-AIO+ Two NS16550 serial/par/game port	.....	\$89.95
GATEKEEPER PC security card	.....	\$49.95
RAMPAT+ 8/16-bit 16Mb RAM card (w/OKB)	.....	\$139.95
SOUNDBLASTPRO 8-bit MIDI sound board	.....	\$199.95

DYNAMIC RAM



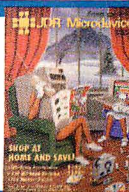
PART #	SIZE	SPEED	TYPE	PRICE
41256-80	256K x 1	80ns	DIP	1.69
414256-80	256K x 4	80ns	DIP	5.49
1MB-80	1M x 1	80ns	DIP	4.99
1MB-60	1M x 1	60ns	DIP	5.49
41256A98-80	256K x 9	80ns	SIMM	14.95
41256A98-60	256K x 9	60ns	SIMM	16.95
421000A98-80	1M x 9	80ns	SIMM	39.95
421000A98-60	1M x 9	60ns	SIMM	45.95
424000A98-80	4M x 9	80ns	SIMM	149.95
424000A98-60	4M x 9	60ns	SIMM	159.95

MATH CO-PROCESSORS intel

PART #	SPEED	PRICE	PART #	SPEED	PRICE
8087-2	8MHz	129.95	80387-SXP	≤25MHz	79.95
8087	5MHz	89.95	80387-DXP	≤33MHz	89.95
80287-XL	12MHz	89.95	80487-SX	≤25MHz	389.95

CALL FOR YOUR FREE JDR CATALOG TODAY!

FOR PC'S, SOFTWARE, MONITORS, DISK DRIVES, KEYBOARDS, MODEMS, CABLES, CONNECTORS, ICs, COMPONENTS, PROGRAMMERS, TEST EQUIPMENT, TOOLS & MORE!



NOW ORDER 24 HOURS A DAY!

800-538-5000

Toll-free Fax Ordering 800-538-5005

Local 408-559-1200 BBS 408-559-0253

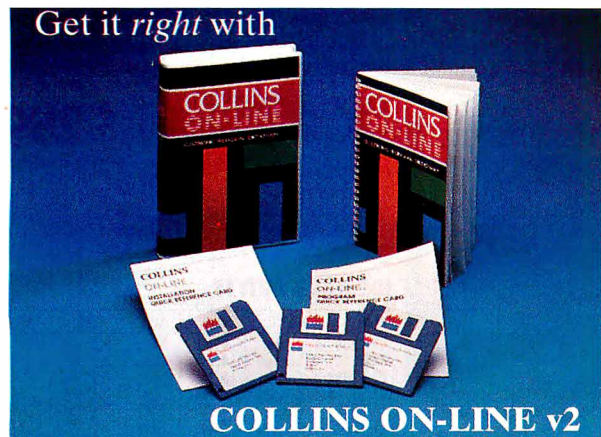
TERMS: For shipping & handling include \$5.00 for ground & \$7.50 for air. Orders over 1 lb. and foreign orders may require additional shipping charges—contact our Sales Dept. for the amount. CA residents must include applicable sales tax. Prices subject to change without notice. We are not responsible for typographical errors. We reserve the right to limit quantities and to substitute manufacturer. All merchandise subject to prior sales. A full copy of our terms is available upon request. Items pictured may only be representative. JDR, the JDR logo, JDR Microdevices, and the MCT logo are registered trademarks of JDR Microdevices, Inc. Modular Circuit Technology is a trademark of JDR Microdevices, Inc. Copyright 1993 JDR MICRODEVICES.

KEY CODE 1038

Books/Publications • Add-In Boards

Lost for the write word?

Get it right with



COLLINS ON-LINE v2

French, German, Italian & Spanish bilingual dictionaries for your PC. Over 40,000 references, 70,000 translations drawn from contemporary use.

FEATURES INCLUDE:

- ☐ **TSR** - memory resident so it can be used with most word processors for MS-DOS.
- ☐ **Look-up** - enables you to find words in the dictionary, choose the appropriate translations and paste them into your document quickly and easily.
- ☐ **Screen-read** - reads words in your document automatically for quick and accurate translation.
- ☐ **Annotate** - allows you to create your own specialized glossaries for use with Collins' world renowned bilingual dictionaries.

English version
(ie with menu items
in English)

HarperCollins Publishers
14 Steep Lane
Findon, Worthing

West Sussex BN14 0UF
UK
Tel: +44 903 873 555
Fax: +44 903 873 633

LinguaTech Int'l Inc
1113 South Orem Blvd.
Orem, Utah 84058 USA
Tel: +1 800 336 6312

(In the US)
Tel: +1 801 226 2525
Fax: +1 801 226 7720

MicroBusiness Italiana Srl
Via Aurelio Saffi 16
20123 Milano M1, Italy
Tel: +39 2 4390421
Fax: +39 2 48193003

German version
(ie with menu items
in German)

European Purchase
Consultants (EPC)
Mauritiussteigweg 64
D-5000 Cologne 1

EPC Germany
Tel: +49 221 24 90 39
Fax: +49 221 24 80 38
HOTLINE +49 221 23 15 96

French version
(ie with menu items
in French)

Softissimo
129 boulevard de Sébastopol
75002 Paris
France

Tel: +33 1 42 33 77 10
Fax: +33 1 42 36 62 63

Circle 371 on Inquiry Card.

Add-In Boards • Communications/Networking

Experience the Power

Parallel Processing

For the professional, student or hobbyist who wants to come up to speed with parallel processing. All kits include one or more 20-MHz 32-bit transputer processors, each with 1MB of DRAM • Occam2, C, and assembler • examples and demos • complete set of manuals • schematics. Requires IBM-compatible PC.

4 Processors: \$1,284 1 Processor: \$396

The Transputer Education Kit is outstanding. You would be hard pressed to find as valuable and inexpensive a tool.

R. Eckhouse, IEEE Computer, Sept. 92, page 97

Computer System Architects

15 N.100 E., #100
Provo, Utah 84606

800-753-4CSA
or 801-374-2300
FAX 801-374-2306

VISA • MasterCard
American Express



Circle 331 on Inquiry Card.

SSD-2HD Intelligent Solid-State Disk

1.44MB max. FLASH/EPROM Disk
w/auto-boot

1.44MB max. SRAM Disk w/battery
backup

Auto-sense installed FLASH/EPROM
/SRAM memory types

Auto-configure Solid State Disk
Drive

Software protection key(PARAKEY)
designed to protect a specified
software application from
unauthorized use.



ACI
1-800-886-ACI-3

U.S.A.

TEL:617-938-8020
FAX:617-938-8037

International

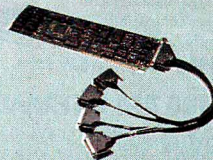
TEL:886-2-758257(Taiwan)
FAX:886-2-7589615

Circle 367 on Inquiry Card (RESELLERS: 368).

PC/AT Four Port Com. Coprocessor

GMM Sync4/CCP™

- High Performance 16 MHz 16 bit CPU.
- 80X86 code compatible.
- 4 Sync/Async Ports
(2 Serial Ports with Full Duplex DMA).
- Uses Zilog 85C30, 85230 SCC chip.
- 512K Dual Ported Ram (STD)
(1, 2, or 4 MEG Dual Port Ram - optional).
- 8k, 16k, 32k, 64k Window Size (Programmable).
- 8 Software Selectable and Shareable
Interrupts.
- RS232/RS422/RS485
- Source Code Debugger Kit Available.



GMM Products Are All Made in USA.

PC/AT Dual Port Com. Coprocessor
also available
GMM Sync2/CCP™

GMM
GMM Research Corporation

Other PC/AT & PS/2 8530 based products available.
Extremely competitive pricing.

(714)752-9447 Fax (714)752-7335

18092 Sky Park South - Unit E, Irvine CA 92714

Circle 338 on Inquiry Card.

ROMDISK™

Solid State Disk and Drive Emulators

- **Proven Performance!**
For OEM/Military, Embedded
Systems, Diskless/High Per-
formance PC's, CAD/CAM,
Industrial Control, Medical,
POS, LAN's, etc.
- **High Capacity Models**
(PCF/PCM)
- **Low Cost Models** (FERO,E/2-
SR/Special OEM)
- **Dual Mode Emulation Models**
(PCF, PCM/2, PCE/2)
- **Autoboot Capabilities**, all
models
- **MS DOS/DR DOS/E-Venix OS**
Support
- **NEW! PCMCIA models**
(PCM, PCM/2) and acces-
sories

CURTIS, INC.

Industry Leader in Disk and Drive Emulation Products

418 W. County Rd. D
St. Paul, MN 55112

612/631-9512
FAX 612/631-9508

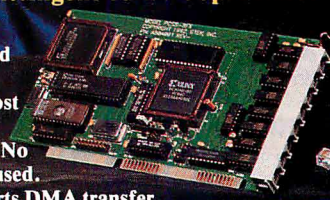
DR DOS is a trademark
of Digital Research;
MS DOS is a trademark of Microsoft

Circle 333 on Inquiry Card.

Light-Speed Serial Communications

PCSS-8FX Intelligent Serial Coprocessor

- **Better than
1Mbyte/second
transfer rate.**
- **No load on Host
Processor!**
- **I/O Mapped - No
host memory used.**
- **NEW - Supports DMA transfer.**
- **Faster than Dual Ported Memory!**
- **Looks like IBM Uart with Huge QUEUE!**
- **8 ports per card. RS-232, 422, 485.**



Fast

**ORDER
TOLL-FREE
800-282-4835**

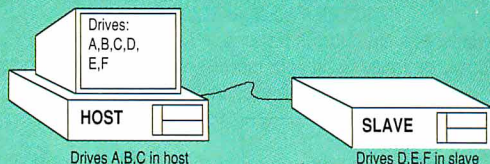
GTEK INC.

GTEK, INC. • DEVELOPMENT HARDWARE & SOFTWARE • P.O. Box 2310
Bay St. Louis, MS 39521-2310 USA • Mississippi & Technical Support 601-467-8048
Fax: 601-467-0935 • OEM & Dealer Inquiries Welcomed!

Circle 339 on Inquiry Card.

RECYCLE Your PC

INFINISTOR restores your old or obsolete PC. Microprocessor driven, this NEW interconnect system enables you to use disk drives in your old PC as if they were mounted within your current PC. Your old PC can also access all of your new PC storage devices if it is initialized as the host. The applications of this connectivity medium are limited to your imagination!



Basic INFINISTOR Configuration

- 200K Bytes per second throughput
- Use Hard Disk, Floppies, RAM Cache on slave
- Simple installation of a half card on each end
- Up to three slaves can be connected to each host
- 5 Year Warranty
- \$299.00 list price - **special introductory price of \$159.95** for host and one slave

INFINICON

101 Library Plaza • 15 North 100 East • Provo, UT 84606

SOON TO BE RELEASED!

INFIN/ACCESS Providing total access of storage devices in your laptop when connected to your desktop. A low cost alternative to docking stations and pocket LAN adaptors.

For Details and Order:

CALL (800) 374-3880

(801) 374-8880

FAX (801) 370-3880

VISA • MasterCard • AMEX

Circle 380 on Inquiry Card.

AT Systems in ROM

- ☐ Single Board Computers
- ☐ Run DOS code from ROM
- ☐ PC Code compatible
- ☐ Large Memory space
- ☐ Backplane systems
- ☐ Develop code on a PC. Run on our CPU cards with DOS and code in ROM. Use off-the-shelf expansion cards.
- ☐ KS6: NEC V53 CPU (286eq), 5 serial, 2 Par, Clock, AT bus, Max 4M Ram, 2M Rom, 512K NV Sram. \$349 (q1-oem ver).
- ☐ KS3: V40 CPU, 3 Serial, 2 Par, Clock, Flop, Kbd. \$249 (q1).



303-444-7737 Fax 303-786-9983
655 Hawthorn Ave., Boulder CO 80304 U.S.A.

KILA

Circle 344 on Inquiry Card.

Rackmount Solutions

RACKMOUNT COMPONENTS - QTY 25 PRICING

Rackmount Chassis 19"x7"x17"	\$183
Rackmount VGA Monitors	\$531
Rackmount Monitor Shelf	\$113
Rackmount Keyboard Shelf	\$88

RACKMOUNT PLATFORMS - Qty 1 Pricing

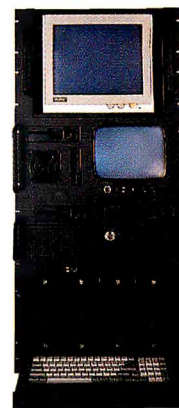
RMS486-33EISA	\$1799	RMS386-40	\$814
RMS486-33	\$1443	RMS386SX-25	\$693

System Platforms include 7" Rackmount Chassis, 200W Power Supply, Motherboard, 1.0MB Memory, IDE, FDC, 2-Ser, Par, 1.2MB or 1.44MB Floppy Disk Drive, 1 Year Warranty

RACKMOUNT CHASSIS - 15 Models up to 20 Board Slots
SLOT CPU BOARDS - 486, 386, 386SX
RACKMOUNT MONITORS - Super VGA and Monochrome
RACKMOUNT CABINET - Modular from 21" to 96" high

VALLEY TECHNOLOGY INC.

2468 Armstrong Street, Livermore CA 94550
(510) 447-2030 FAX: (510) 447-4559

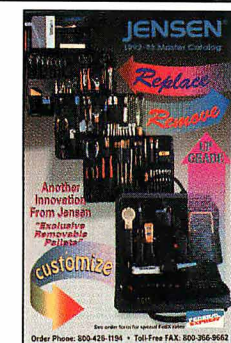


Circle 364 on Inquiry Card.

FREE CATALOG

Contains 284 pages of quality tools and tool kits, service diagnostics and test equipment for maintenance of computers and communication systems. Also LAN products: cables, taps, connectors, transceivers, repeaters, assemblies, and more. Free shipping, free technical support, 100% guarantee.

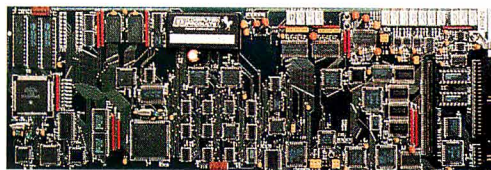
JENSEN



Jensen Tools Inc.
7815 S. 46th St., Phoenix, AZ 85044
(602) 968-6231 • Fax (800) 366-9662

Circle 343 on Inquiry Card.

The Intelligent Solution For Data Acquisition



DAP 2400e™ Data Acquisition Processor™

ANALOG I/O

DIGITAL I/O

- Inputs to 312K samples per second
- Outputs to 312K samples per second
- Simultaneous fast input/output
- FFT and FIR-filtering

Digital Signal Processing at 16 MIPS

20 MHz CPU with DRAM to 1024K

32 MHz DSP with SRAM to 96K

DAPL™ Operating System

- 100+ standard commands
- Custom commands in C

MICROSTAR LABORATORIES
2265 116th Avenue NE
Bellevue, WA 98004
FAX (206) 453-3199

Send for **FREE** catalog and demo diskette.
Or call us at (206) 453-2345.

Circle 347 on Inquiry Card.

BLAST YOUR MESSAGE THRU!

Voice Mail • Telemarketing • Call Processing

Transform your PC/XT/AT/386 into a multi-line processing command center. intelligently process your sales, inquiries, and messages. Complete package.

(Developer/OEM packages available)
VISA—MC—AMEX—COD

Multi-Line (Voice Solution) \$695
SINGLE LINE (BignMouth) \$295

For Sales or Information:
Call 1-800-685-4884
CALL: (510) 522-3800 • FAX: (510) 522-5556

TALKING TECHNOLOGY, INC.
1125 ATLANTIC AVE. • ALAMEDA, CA 94501

Circle 354 on Inquiry Card.

PS/2 Hard Drives

PS/2 50 50z 55sx 60 70 80 P70

INTERNAL DRIVES - May be used as a high performance replacement or to co-exist with original IBM drive. Compatible with DOS 3.3, 4.01, 5.0, OS/2 2.0 and Novell. Includes IDE or SCSI-2 microchannel controller, hard drive, mounting kit, ribbon & power cable, manual, and hardware.

85mb, 17ms, Internal Western Digital IDE Drive Kit	\$459
125mb, 15ms, Internal Maxtor IDE / SCSI Drive Kit	\$553/\$589
200mb, 15ms, Internal WD IDE/Maxtor SCSI Drive Kit	\$689/\$779
340mb, 13ms, Internal Maxtor IDE / SCSI Drive Kit	\$969/\$979
512mb, 12ms Internal Fujitsu IDE / SCSI Drive Kit	\$1,313/\$1,369
1.05gb, 10ms Internal Microplus SCSI Drive Kit	\$2,184

PS/2 Model 25, 30, 30-286
32mb/42mb Hard Drive Kit \$217/\$257
85mb/125mb Hard Drive Kit \$339/\$433

External SCSI drives available from 125 mb to 1.75 gb. Includes SCSI-2 controller, external case with drive installed and configured, 6' SCSI cable. Free drivers for CD-Rom drives or Novell 286 & 386.

General Technics
1-800-GT-SALE-8

Tel: (516) 981-9473
Fax: (516) 981-5038

38 Reynard Ave.
Ronkonkoma NY 11779

Open 9am to 6pm
EST, Mon-Fri

Circle 375 on Inquiry Card.

Disk & Optical Drives • Keyboards

Connect with the Parallel Universe

SIGEN 250MB PORTABLE PARALLEL PORT TAPE BACKUP

No controller card required. Connects to parallel port. Installs in less than 3 minutes. Great for Laptops. To 9.5 MB/min transfer rate.

Capacity
20 MB Parallel Port Floppy
80/250 MB 1/4" cartridge 4.5 MB/min
60/200 MB 1/4" cartridge 9.5 MB/min
250/500 MB 1/4" cartridge 9.5 MB/min
1.3 GB 1/4" cartridge SCSI 18 MB/min
1.2 / 2 GB 4mm DAT SCSI 10MB/min

Supports
DOS, OS/2
Novell 286, 386
UNIX, XENIX

Industry standard SYTOS PLUS, or CENTRAL POINT BACKUP software and for file server based NLM and VAP TAPEWARE.



SIGEN

PHONE (408) 737-3904 • FAX (408) 737-3910

Circle 357 on Inquiry Card.

MiniSCSIplus

HIGH PERFORMANCE PARALLEL-TO-SCSI ADAPTER

Transform Your Parallel Port – Connect up to 7 SCSI devices to your parallel port and still use your printer!

Up to twice as fast as our original MiniSCSI, the MiniSCSI Plus lets you run a CD-ROM, tape drive, SCSI hard disk, SyQuest, Bernoulli or other SCSI device from almost any parallel port. For most notebook users, it's the only way to use SCSI CD-ROMs and tape drives. Plus, its integrated cable makes it a snap to move and share SCSI devices between desktops and notebooks.

Call For Details!
800-872-6867
(800-TRANTROR)



Trantor Systems, Ltd.
5415 Randall Place
Fremont, CA 94538-3151
TEL: (510) 770-1400 • FAX: (510) 770-9910

© 1992 Trantor Systems Ltd. MiniSCSI and MiniSCSI Plus are trademarks of Trantor Systems Ltd. All other product names are trademarks of their respective companies.

Circle 363 on Inquiry Card.

Money Back Guarantee & 1 Yr. Warranty

**Popular
Space-Saver
Keyboard
\$98.00**

Saves 60% desk space. Foot-print 27.3 x 15.2 cm. 100 full-travel tactily responsive keys. Standard left-right spacing for easy touch typing. IBM XT/AT PS 2 compatible. Many language versions available.

Call Toll Free To Order: 1-800-DATALUX

DATALUX

– VISA, MC, AmX –



155 Aviation Dr. • Winchester, VA 22602
Tel 1-703-662-1500 • FAX 1-703-662-1682
Auto-FAXed Specs FAX 1-703-662-1675

Circle 335 on Inquiry Card.

Graphics Tablets/Mice/Pen Input • Laptops & Notebooks

FREEDOM!

We fight for it...even die for it! Fortunately in this case we can have it for less than \$30 dollars.

The **FREEDOM STATION®**

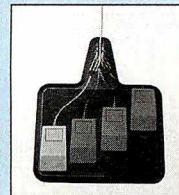
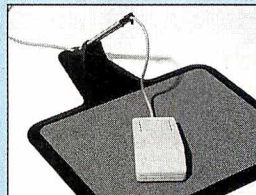
Welcome to the Future of Mouse Computing.

The ultimate accessory for your computer mouse!

A mouse peripheral designed by users, for users, worldwide!

BETTER THAN WIRELESS

▪ No Batteries ▪ No sluggish response ▪ No loss of resolution ▪
Professionally designed to rid your mouse cord of that nasty habit of getting caught on everything in sight!



Made in Maine USA

Worldwide Patents Pending

The FREEDOM STATION projects, suspends and locks your mouse cord above the workstation. The projection tower enables the cord to freely rotate around the workspace following your mouse as you go about your work. The FREEDOM STATION'S unique freedom of motion lies in the design of

the suspension tower. The tower is made of dual balanced flexible compression coils and a projection clip. In order to simulate the feeling of a wireless mouse, the tensile strength, length, height and even the angle of the tower were evaluated and tested for optimum performance.

The FREEDOM STATION includes the suspension tower, cord tip guide, baseframe, cord locking channels and a high quality 10X7.5 proportional mousepad.

MS-PRO FREEDOM STATION®

Orders Only 800-452-7546

30-Day Money-back Guarantee if not 100% satisfied.
2-Year Unlimited Warranty

C.P. Research

\$29.95 \$US

(\$5H included continental US only)

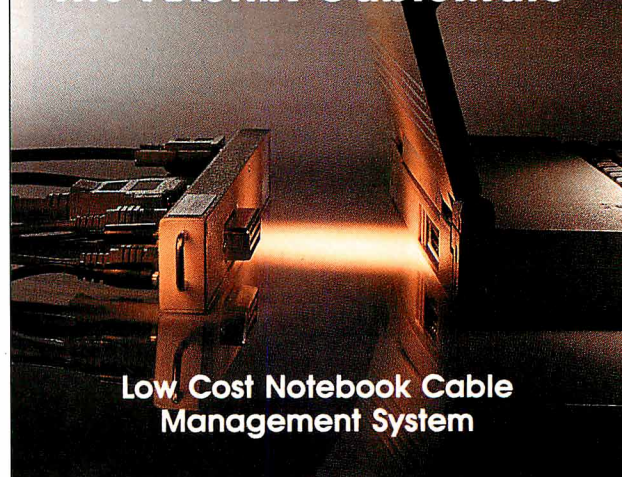
Dealer Inquiries Welcome

Call **800-582-2909**

Fax **207-775-6779**

Circle 372 on Inquiry Card (RESELLERS: 373).

The Axonix CableMate™



Low Cost Notebook Cable Management System

Now you can connect your desktop peripherals in one easy step while reducing wear and tear on your interface ports. The CableMate Plus option provides bus expansion for low cost ISA compatible Lapstation expansion systems and both versions are available for Compaq LTE, Toshiba T2200-T6400 and other popular Notebook models. CableMate and Lapstation are available from Axonix direct, and from Authorized Axonix dealers worldwide.



1214 Wilmington Avenue
Salt Lake City, Utah 84106
Tel: 801-466-9797 / Fax: 801-485-6204

Call Toll Free for Nearest Dealer 1-800-866-9797

Circle 381 on Inquiry Card.

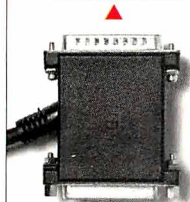


Universal Keypad for Portable Computers

Available in Ivory or Black

Boost data entry speed, accuracy and convenience with Genovation's Micropad,™ the innovative numeric keypad for portable computers.

TO COMPUTER



TO PRINTER

(800) 822-4333

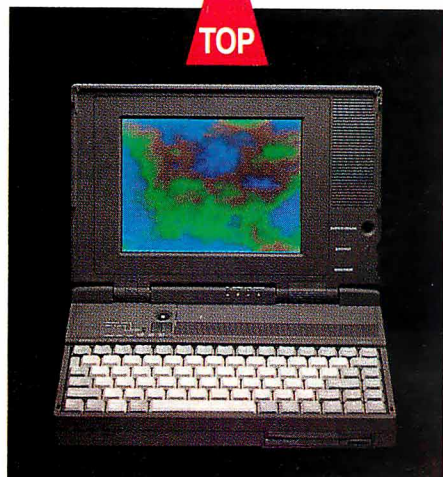
17741 Mitchell, North
Irvine, CA 92714 USA
TEL (714) 833-3355
FAX (714) 833-0322

Is the unhandy numeric section of your portable computer's keyboard dragging you down?...Give your productivity a boost by using our Micropad. The ergonomically designed Micropad is ideal for spreadsheet and accounting applications that require fast and accurate entry of numeric data.

The Micropad attaches to the parallel port of any MS-DOS computer while providing a clean pass through connection to the printer. Power usage is negligible. Lightweight and compact, the Micropad is fully programmable and is also available with connectors to fit keyboard and serial ports.

GENOVATION

Circle 337 on Inquiry Card.



486SLC Color
2MB RAM,
80MB HDD
DOS, and
Trackball
\$2,229

TOP PC

"we're the notebook company..."

From 386-mono to 486-color,
We have a Notebook for Everyone.
AT MANUFACTURER-DIRECT PRICES.

All Inquiries Welcome. Mon. to Fri. 8AM - 6PM Sat. 10AM - 3PM PST.

1-800-333-8144

For more information about our complete line of notebook products, please contact:
TOP PC International, Inc., 638 N. Eckhoff St., Orange, CA 92668 Tel: (714) 939-1416 Fax: (714) 939-0103

Circle 378 on Inquiry Card (RESELLERS: 379).

Industrial PC Solutions

RELIABLE, AFFORDABLE, FLEXIBLE

- Industrial PCs
- 286/386/486 CPU Cards
- RAM/ROM Disks
- Industrial I/O Cards
- PC-Bus Card Cages
- Rack Mount Keyboards

1-800-800-6889
(In California 408-293-6786)

ADVANTECH

1310 Tully Road, #115, San Jose, CA
FAX: 408-293-4697



FREE! New 140-page PC-based industrial automation reference guide for your system and OEM needs.

Circle 330 on Inquiry Card.



Memory Superstore . . . your direct source.
...For the absolute best prices on laptop, desktop and workstation memory, call now! 800-800-7056.

Standard SIMMS	
4MB x 9-80/70***	\$110.00
4MB x 9-60	\$114.00
256K x 9-80/70	\$11.00
1MB x 9-80/70 (9 chip)	\$34.50
1MB x 9-80/70 (3 chip)	\$31.00
1MB x 36-70*	\$136.00
2MB x 36-70*	\$262.00
4MB x 36-70* ***	\$499.00

Call for best price on a 30-pin & 72-pin Modules, 2, 4, 8 & 16MB

*used in PS/2, Compaq, Dell & other high-end systems (386 & 486)
**4 piece minimum

Laser Printer Memory	
Canon 1MB	\$118.00
LBP 8II/8IIR/8IIT 4MB	\$190.00
Epson Action Laser 2MB	\$125.00
Action Laser II 2MB	\$138.00
HP LaserJet IIP, IIPPIs, III, IIID, IIP, II, IIDI, IISi 2MB	\$99.00
4MB	\$172.00
HP DeskJet 256K	\$78.00
IBM 4029*** 4MB	\$140.00
Sharp JX9500PS 1MB	\$75.00
OKI Laser OL400 2MB	\$116.00
OL800/820 2MB	\$135.00
4MB	\$210.00
2MB	\$135.00
Panasonic KXP4420, 4450I 2MB	\$175.00
KXP4455 4MB	\$215.00
KXP4410 4MB	\$215.00

IBM & Compaq Memory	
PS/2, 35SX/LS, 40SX, 50Z, 55SX/LS, 57SX, 65SX/LS, 70, 70A21, B21, B61, 90, 95 2MB	\$89
4MB	\$136
8MB	\$268
DeskPro386/20.E, 25.S, 16.N, SX20, 33M 2MB	\$89
4MB	\$136
8MB	\$268

Workstation Memory	
Sun EPC/IPX*** 16MB	\$470
Dell 486 16MB	\$495
IBM RS6000 16MB	\$620
HP Apollo 16MB	\$675
Silicon Graphics 16MB	\$620
Next 16MB	\$470

Specialists in workstation products. Contact us for current prices & new catalog.

Laptop/Credit Card/Flash Memory	
Apple Power Book★ 4MB	\$230
AST Premium Exec. 4MB	\$160
AT&T Safari 4MB	\$345
Bondwell B310 1MB	\$136
Compaq LTE386s/20 1MB	\$82
4MB	\$259
LTE Lite/20.5 2MB	\$140
4MB	\$240
8MB	\$578
LTE/286 1MB	\$88
2MB	\$138
SLT/286 1MB	\$88
4MB	\$240
Goldstar GS520 4MB	\$330
HP 95LX, Poquet PC, Grid Pad SRAM Card 256K	\$122
512K	\$149
Flash Memory 1MB	\$238
2MB	\$309
Packard Bell, Magnavox, Mitsuba*** 2MB	\$150
4MB	\$290
Toshiba - T1000SE/LE/XE, T2000SX, T1000LE, T2200-SX, T2000SXE 1MB	\$80
2MB	\$109
4MB	\$230
8MB	\$430
Toshiba - T1200XE 2MB	\$88
Toshiba - T4400 SX/SXC, T3300, T6400 2MB	\$182
4MB	\$329
6MB	\$469
8MB★	\$670
Zenith Masters SL 2MB	\$122

Memory Superstore



(800) 800-7056

OR (805) 339-0305
FAX (805) 339-0353

Circle 366 on Inquiry Card.

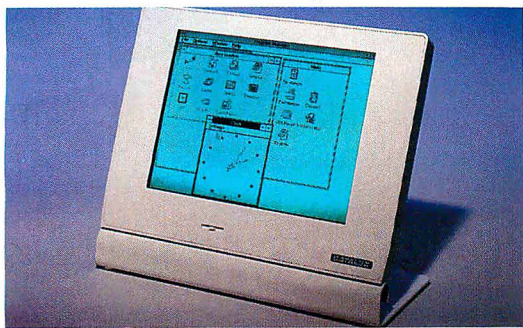
Let your "true colors shine through" when you advertise your computer products in BYTE's
HARDWARE/SOFTWARE SHOWCASE
our newest, affordable, 4-color advertising section!

Call for more details:
(603) 924-2695 or (603) 924-2598

Monitors & Terminals • Multimedia

STAND-ALONE LCD MONITOR

New Touch Screen Option Available



\$995 This 10" black on white monitor is easy-to-read, yet compact. Resolution is 640x480 for sharp, flicker-free image. Fast response, high refresh rate twisted nematic technology with backlighting provides a bright low radiation screen with a wide viewing angle. The adjustable monitor base is only 29x14 cm. It lets you mount the LCD monitor on vertical surfaces or fold for transport. Comes with 1.5 m cable and controller card. No external power required. IBM AT compatible.

\$1,495 New Touch Screen Option. Capacitive technology from MicroTouch™. Provides high resolution, fast response, all glass scratch proof optically clear touch sensor. Complete with controller and software. DOS Windows compatible.

To Order Call Toll-Free: **1-800-DATALUX**

DATALUX

Tel: 1-703-662-1500

FAX: 1-703-662-1682

AutoFAXed Specs:

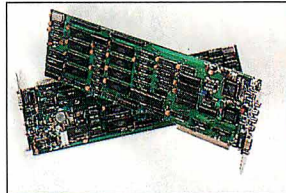
1-703-662-1675

155 Aviation Drive • Winchester, VA 22602

Circle 334 on Inquiry Card.

Multimedia • Printers/Plotters • Programmable Hardware

IMAGING CARDS



Video Framegrabbers for the XT/AT/386

- Real time grab/display
- Complete with software
- 60 & 50 Hz. Video
- Quality since 1987!
- Money back guarantee

MODEL 1-800-292-1160

- 512/24 512x480x24 - New Full 24 bit color board, mult. in, 24 bit RGB out\$795
- 512 512x480x8 - Advanced grayscale board. Multi res/multi image, 4 inputs, in/out LUTS, dual ping-pong buffers, RGB out\$795
- 02 256x240x8 Workhorse 8 bit grayscale. 2 inputs, 24 bit RGB out, cursor\$495
- 03 256x240x6 Economy 6 bit version of -02 above\$395

Control Vision

Box 596 Pittsburg, KS 66762
316-231-6647 Fax: 231-5816

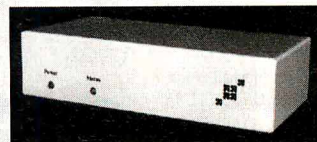
Circle 332 on Inquiry Card.

SMART PRINTER BUFFER

Allows automatic sharing of printer(s) by several computers.

Nobody waits!

- simultaneous input on all ports
- compatible with all printers, Lasers and CAD plotters
- Pop-up Menus
- Free Technical Support
- 30 day money-back guarantee & full-year limited warranty



STANDARD 1 MB memory • memory sizes thru 8 MB
• Fast - data rates to 100 KB/S • multiple copies • multiple outputs

NEW

1 MB 6-Port Parallel
\$199⁹⁵

9-Port Parallel \$249.95
12-Port Parallel \$299.95
8-Port Serial + 3-Port Parallel \$269.95
16-Port Serial + 3-Port Parallel \$399.95

Single User Parallel
\$99⁹⁵

512 KBytes - unit is expandable to 4 MB
Serial or Converting buffers available

Other Models also available - Call!

Extra Memory: \$50 per Megabyte

Technologic SYSTEMS

513-644-2230 • FAX 644-2232

Made in USA

204 EAST FOURTH STREET, MARYSVILLE, OHIO 43040

Receive FAX Info On-Demand: (805) 650-3299 - Item # 700

Circle 355 on Inquiry Card (RESELLERS: 356).

Make Your Image Fly!

...with our MultiMedia Solutions.



Video Master - Video & Audio In/Out Board
• Full Motion Video with Image Capture and Presentation
• VGA to Flick Free Video & Stereo Sound Mixing
• User Developer Kit Available



Video Blaster - Image Capture Board
• Live Video, True Color, Windowing Video Capture & Sound Controller
• User Developer Kit Available



SOUND BLASTER PRO
• OPL-3 stereo FM Music Synthesizer
• Digital-Analog Mixer



VGA / TV CONVERTER



TOUCH SCREEN PANEL

for 14", 17" and 19" VGA Monitor



PICTURE PACKER
JPEG Compression Soft/Hardware



WinJet 800 / 1200
800/1200 DPI for HP LaserJets



CD-ROM MultiMedia Upgrade Kits
540 MByte CD-ROM with MultiMedia Interface



OPTICAL DISK DRIVES
1550 Mbyte/19ms & 256 Mbyte/35ms Magneto-Optical, Writable Drives



VIDEO PHONE by VidCall™ Software
• Transmit Live Video via VideoBlaster, Camera & Modem
• Receive Live Video via Modem

Call Us Now! For Free Consultation & Catalogs

800-446-1967

EMPIRE COMPUTECH

9668 Hermosa Ave.
Rancho Cucamonga, CA 91730
Tel: 909-466-1400 Fax: 909-466-1409

Circle 370 on Inquiry Card.

IEEE 488.2 for Notebook PCs

- Attaches to the PC's parallel printer port
- Controls up to 14 IEEE instruments
- Transfers data at up to 170 Kbytes/sec
- Includes DOS or Windows software drivers
- Graphics & analysis software available
- Allows parallel & IEEE devices to be connected simultaneously

Call or fax for more information:

Tel (216)-439-4091

Fax (216)-439-4093

iOtech

the smart approach to instrumentation

iOtech, Inc. • 25971 Cannon Road • Cleveland, Ohio 44146



Circle 340 on Inquiry Card.

Programmable Hardware

UNIVERSAL PROGRAMMERS & TESTERS

TUP-400 \$745 TUP-300 \$575

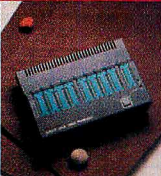
- Program PLD (PAL, GAL, EPLD, PEEL, MAPL, MAX, MACH...), E(E)PROM (Up to 16Mbit), BPROM, SERIAL PROM, FLASH, MPU (87XX, 68XXX, 68HCXXX, PIC16XX, TMS320XXX, Z8, PSD3XX, HITACHI, NEC...)
- 40 pin DIP socket standard. Expandable to support PLCC, (T) SOP, SOIC, QFP, PGA, SIMM/SIP... with up to 84 pins.
- Tests TTL74, CMOS, 40/45, DRAM, and SRAM.
- Optional EPROM EMULATION capability.



PRODUCTION E(E)PROM PROGRAMMERS

QUICK-32 \$695
for PC-based version

- Programs up to 8Mbit 32 pin 27 (C) xxx devices.
- Supports 28FXXX and 29CXXX.
- One master and 8 gang sockets are standard.
- Programs 8 27C010 EPROMs in only 26 seconds on a 286/16 PC.
- Other EPROM Programmers available starting at \$175.
- Stand-Alone versions available also.



8051 IN-CIRCUIT EMULATORS

NICE-31 System \$1295

- Supports 80(C) 31/32, 80C51FA/FB, 8344, 80C851, 80C652/654

NICE-52H System \$1695

- Supports 80 (C) 31/32, 80C51FA/FB, 8344, 80 (C) 51, 80 (C) 52.
- Other systems available. All systems include a NICE-51 emulator unit with 128K emulation memory, a 16K deep and 48 bits wide real-time trace recorder, symbolic and C source level debuggers, and a processor specific POD. All systems can be upgraded to support other 8051 derivatives.



ROM/RAM EMULATORS

TRE-200 \$295

- Emulates up to two 27 (C) 512 devices at one time..
- Optional 1Mbit emulation capability.
- Two independent ROMs or even/odd emulation.
- 2Mbit Emulator and Programmer/Emulator systems also available

PLCC, QFP, SOP...CONVERTERS
AVAILABLE FOR ANY PROGRAMMER

All products are backed with a 1 year warranty and a 30 day money back guarantee.

CALL TODAY FOR MORE INFORMATION



Tribal Microsystems Inc.

44388 S. GRIMMER BLVD., FREMONT, CA 94538

Tel (510) 623-8859

FAX (510) 623-9925

Circle 358 on Inquiry Card (RESELLERS: 359).

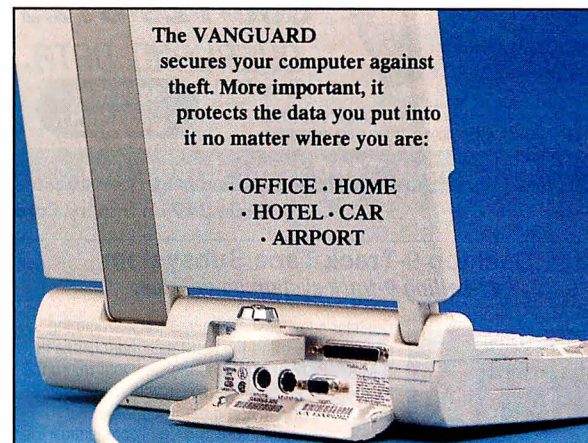
Security • Tape Drives

Now you can take it with you.

The *Käblit*

VANGUARD

Physical Security for
NOTEBOOKS • LAPTOPS • PORTABLES



The VANGUARD
secures your computer against
theft. More important, it
protects the data you put into
it no matter where you are:

- OFFICE • HOME
- HOTEL • CAR
- AIRPORT

Pat Pend

- Installs in seconds...as easy as installing a computer cable.
- Attaches to any unused 9 or 25 pin port screws.
- Fits all computers except Macintosh.

List Price - \$49.95

Call for complete details.

Secure-It

18 Maple Court
East Longmeadow, MA 01028

800-451-7592

413-525-7039

Circle 352 on Inquiry Card (RESELLERS: 353).

SUPERPRO®
now \$599 (US only)

Over 2,000 devices, desktop
programmer for your IBM PC
with high speed & reliability

- Easy to use menu driven Software.
- Universal programming for E(E)PROM, Flash E(E)PROM, Bipolar PROM, PAL, FPL, PEEL, GAL, E(E)PLD, & Microcontroller, etc.
- Test TTL/CMOS logic ICs, & memory (DRAM/SRAM).
- Life time free Software updates on BBS & technical support.
- 1 year Hardware warranty & 30 day money back guarantee.
- Developed & made in U.S.A.
- Call for demo disk.

Distributors are welcome!!



E(E)PROM programmer to 4-Mbit

- ROM MASTER: \$149
- E(E)PROM programmer 4 gang version
- ROM MASTER/4: \$239

757 N. Pastoria Avenue, Sunnyvale, CA 94086

(408) 524-1929

FAX (408) 245-7084 BBS (408) 245-7082

XELTEK

Circle 361 on Inquiry Card.

COMPUTER PROTECT

COMPUTER SECURITY DEVICE

Innovative device to protect your computer system

General Features:

- Protect computer from unauthorized booting
- User-defined and changeable password with maximum 8 digits
- Two level passwords to distinguish different users
- Lock floppy disk drive
- Reject copying data from hard disk
- Prevent writing data to hard disk from unexpected floppy disk (which might be virus-infected)
- Simplify the keyboard locking into a one-button operation
- Easy installed as floppy disk drive
- Fits all pc computer systems

WENTEK Technology Inc.

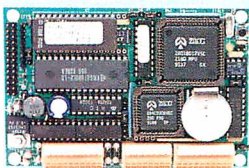
12921 Ramona Blvd. #1, Irwindale, CA 91706
Tel: (818) 960-8808 Fax: (818) 960-1256



Circle 374 on Inquiry Card.

NEW! Little PLC™ Program It In C \$195!

New **Little PLC™** measures only 4.33 x 2.85 inches and costs \$195! This miniature controller includes 8 optically isolated inputs, 8 relay driver outputs, two RS-485 serial ports, battery backed memory and time/date clock, programmable timers, and watchdog. Low cost expansion cards increase digital and analog I/O. With easy to use **Dynamic C™** \$195 development system, you can write programs in an hour or develop major applications with 20,000 lines of C language.



Z-World Engineering (916) 757-3737

1724 Picasso Ave., Davis, CA 95616 • FAX: (916) 753-5141
24 hr. Data Sheet Retrieval from YOUR fax: (916) 753-0618

Circle 362 on Inquiry Card.

9 Track/3480 Tape Subsystems

1/4" DAT 8mm Optical

New Windows Software Available

- Best Quality
 - Lowest Prices
- 800/1600/3200/6250 BPI
CALL 1-800-859-8856



Laguna Data Systems

23151 Alcalde Drive, Suite B-3, Laguna Hills, CA 92653
Tel: 714-586-3010, Fax: 714-586-5538



Circle 346 on Inquiry Card.

Tape Drives • Data Acquisition

9-Track for PCs

Mainframe to PC data interchange

Rock solid solutions, rock bottom prices.

Direct from the manufacturer. 1600 & 6250 bpi.

Subsystems include drives and software.



800-729-8725

OVERLAND DATA®

Since 1980

**3480 Now
with IDRC!**

See us at CeBIT '93

Tel: 619-571-5555 • FAX: 619-571-0982

Europe: Tel: (+49) 6172-35027 • FAX: (+49) 6172-35028

Ask about 3480 tape drives too

Circle 349 on Inquiry Card.

Desktop 9-Track Tape Subsystem

#1-selling 9-track system on desktop.



Qualstar's low cost 1/2-inch 9-track Streaming tape systems bring full ANSI data interchange to IBM AT, PS/2 or Macintosh, giving your micro the freedom to exchange data files with nearly any mainframe or minicomputer in the world.

Systems include DOS or Xenix compatible software, coupler card and cables. High reliability 1600 or 6250 BPI capability may be used for disk backup as well as data interchange.

QUALSTAR®

**Call us today! For details and
to order: Fax (818) 882-4081
Phone (818) 882-5822**

9621 Irondale Ave., Chatsworth CA 91311

©1989 Qualstar Corp.

All product and company names and trademarks are the exclusive property of their respective owners.

Circle 351 on Inquiry Card.

Free Data Acquisition Software Tool



DAQ Designer is a free software tool that helps determine which hardware and software combinations are best for your PC-based data acquisition system. DAQ Designer will (1) ask questions about your application, (2) analyze your answers to determine your system needs, and (3) describe what hardware and software you need to develop your data acquisition system.

National Instruments

6504 Bridge Point Parkway

Austin, TX 78730

(512) 794-0100 • (800) 433-3488

Circle 348 on Inquiry Card.

Business • Engineering/Scientific • Graphics

Dealers Wanted

MicroBiz, the nation's leading POS software developer, is currently looking for 200 additional dealers to supplement its nationwide dealer network. The MicroBiz Controller Series is available for the following markets: Retail • Video • Auto Repair • Liquor • Rental • Hair/Nail Salon • Restaurant, Dry Cleaner and more...

Dealer Inquiries Welcome • Call for a FREE catalog
French and Spanish versions available

MicroBiz
AUTOMATE YOUR BUSINESS™

800-637-8268

Fax: (914)425-4598 Ph: (914)425-9500

BBS: (914) 425-6440

Circle 376 on Inquiry Card (RESELLERS: 377).

FINALLY, SERIOUS PC HARDWARE DIAGNOSTICS!

**STOP SCRAPPING
FAULTY MOTHERBOARDS**

If you've been disappointed with traditional diagnostics and "Passive Post Cards," or are looking for an alternative to high cost ATE Systems - Put V-ATE plus to the test! We're certain you'll find V-ATE the best investment you've made in years.

- Find Failures in 100% DEAD Systems
- Find Intermittent Faults
- Test for PC Compatibility and reject Sub-standard or Faulty hardware
- US prices from \$995



VISTA MICROSYSTEMS, Inc.

6 Whipple St., No. Attleboro, MA 02760

Tel. 508-695-8459 • FAX 508-695-8688

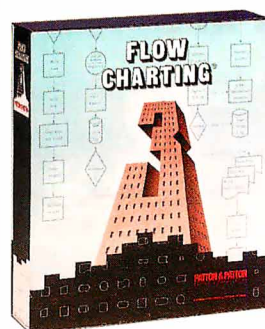
Circle 360 on Inquiry Card.

FLOW CHARTING 3

Powerful new features - for greater speed, flexibility, and ease-of-use!

- Single-page, multi-page or canvas charts - portrait or landscape
- Custom fonts support high resolution laser and 24-pin dot matrix printers
- 35 standard shapes, 10 text fonts
- Suggested retail price: only \$250

See your dealer today! or, for a "live" interactive demo disk, call: 800-525-0082, ext 1218
International: 408-778-6557, ext 1218
fax: 408-778-9972



PATTON & PATTON
Software Corporation

Circle 350 on Inquiry Card.

APL Complete APL system \$60.

J Ken's new APL for teaching and research. Shareware and documentation \$24. Source \$90.

NEW! True Windows 3.1 versions.
GUI programming for APL and J

Iverson Software Inc.

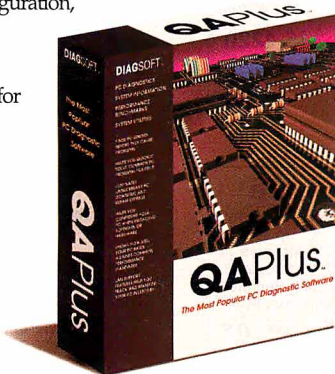
33 Major St., Toronto, Ontario, Canada M5S 2K9
Phone (416) 925-6096 Fax (416) 488-7559

Circle 369 on Inquiry Card.

PC Diagnostics and System Information

QAPLUS™ Over 3 Million users

- ❑ New Version 4.7 now includes Reachout™ Host remote control software and Novi™ Scan virus detection software
- ❑ Both novices and expert PC users can quickly solve common computer problems
- ❑ Reports hardware configuration, interrupts, performance benchmarks and more
- ❑ Includes LAN features for networked PC support and management



For More information call:

1-800-DIAGSOFT

Also from DiagSoft: **QAPLUS/WIN™** for tuning and troubleshooting Windows and **QAPLUS/FE™** for power-users and service/support professionals.

Available from Egghead Discount Software, Comp USA, Biz Mart, Fry's Electronics and other fine resellers.

DiagSoft, Inc., 5615 Scotts Valley Drive, Suite 140, Scotts Valley, California 95066 • 1-408-438-8247 • FAX 1-408-438-7113
Suggested Retail: \$159.95

Circle 336 on Inquiry Card.

Programming for Microsoft Windows
doesn't have to be a Pane for C++

object-Menu™ 2.0

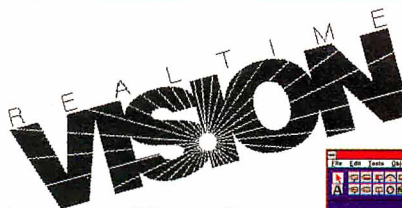
object-Menu provides an object-oriented architectural framework for your C++ application with a dazzling look and feel. Seamlessly port your product between DOS graphics and Microsoft Windows using our interface objects. Our intuitive architecture and natural programming syntax increase your productivity more than you ever thought possible. Our goals are to simplify GUI design for the novice while providing the power and flexibility needed by an expert.

Call today for a free demo!

7 Mountain Rd, Burlington MA 01803
Tel: (617)273-0421 Fax (617)270-4437
BBS (617)270-9552



Circle 341 on Inquiry Card (RESELLERS: 342).



The software
that brings
real-time
graphics to all
Windows users.



With Realtime **VISION**, you can display real-time data from any Windows software. Set up a DDE link, and **VISION** will show your data changing in real time. **VISION** includes the following tools:

Display Objects: TY plots, XY plots, numeric meters, VU meters, gauges, vertical/horizontal bars and lines, and filled TY plots.

Control Objects: toggle switches, pushbuttons, knobs, sliders.

Animation Tools: (optional) Rotation, translation (x and y directions), reduce/enlarge, change object color.

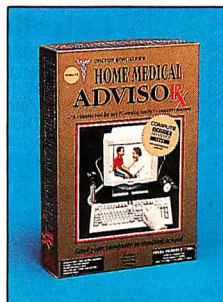
VISION, includes software to immediately start monitoring databases, network performance, and PC performance.

	List Price	Intro
Realtime VISION	\$295	\$99
Animation Tools	\$195	\$49
Developer's Edition	\$995	\$495

To order, call
1-800-TRY-LABTECH
(508) 657-5400 • FAX (508) 658-9972

Circle 345 on Inquiry Card.

IS THERE A DOCTOR IN THE HOUSE?



Nominee Compute Choice Award
Best Adult Discovery Software
WINDOWS VERSION



- **Dr. Schueler's Home Medical Advisor** gives updated info on diseases, injuries, medical tests, drugs, poisons, nutrition, diets, fitness, and health/travel tips.
- Q/A format analyzes your symptoms, shows you anatomical displays, and makes over 400 diagnoses.
- Hypertext and SCAN features make finding any topic FAST.
- Low cost updates to all registered users.
- Developed by over 40 physician specialists.

Available in WINDOWS or DOS versions \$99.95 Retail
WINDOWS Special: **\$79.95**
DOS Special: **\$69.95**

To order, Call: **1-800-788-2099, Dept. B**
or see your software dealer

PIXEL PERFECT INC.
10480 S. Tropical Tr.
Merritt Island, FL 32952



Circle 365 on Inquiry Card.

THE BUYER'S MART

A DIRECTORY OF PRODUCTS AND SERVICES

THE BUYER'S MART is a unique classified section organized by product category to help readers locate suppliers. Each ad has Inquiry numbers to aid readers requesting information from advertisers.

AD FORMAT: Each ad will be designed and typeset by BYTE. Do NOT send logos or camera-ready artwork. Advertisers should furnish typewritten copy. 2"x1 1/8" ads can include headline (23 characters maximum), descriptive text (300 characters is the maximum recommended) plus company name, address, tele-

phone and fax number. 2"x2 1/2" ad has more space for descriptive text (850 characters is the maximum recommended).

DEADLINE: Ad copy is due approximately 2 months prior to issue date. For example: November issue closes on September 8. Send your copy and payment to: THE BUYER'S MART, BYTE Magazine, 1 Phoenix Mill Lane, Peterborough, NH 03458. For more information call: Margot Gnade at 603-924-2656. FAX: 603-924-2683.

RATES (Jan. 1993)

	3-5 Issues	6-11 Issues	12 Issues	13 Issues
2"x1 1/8"				
1 ad	\$663	\$636	\$557	\$530
2 ads/issue	—	—	530	504
3 ads/issue	—	—	504	477
2"x2 1/2"				
1 ad	\$1,326	\$1,272	\$1,114	\$1,060
2 ads/issue	—	—	1,060	1,008
3 ads/issue	—	—	1,008	954

ACCESSORIES

RADIOACTIVE?

Plot it on your PC with The RM-60 RADIATION MONITOR. Serial or printer port. Detects: ALPHA • BETA • GAMMA • X-RAY. MicroR, 1000 times the resolution of standard geiger counters. Excellent for tracking RADON GAS. Find sources. New: Version 2.9 + WINDOWS. Plot: • Background • Cosmic Rays • Clouds • Foods. Call/Write for PC MAGAZINE review. • TSR • GM Tube VISA/MC/EURO Phone orders. Not satisfied? Full refund.

800-729-5397 or Tel/Fax: (302) 655-3800
Aware Electronics Corp.
 P.O. Box 4299, Wilmington, DE 19807 **\$149.50**

KEYBOARD, VIDEO, MOUSE, AUDIO

Extend signals from PC with **EXTENDER**. Split signals with **COMPANION/PC EXPANDER**. Switch signals among PCs with **COMMANDER**. Boosts signals up to 600 feet. Control up to 96 PCs with one keyboard, monitor and mouse.

CYBEX CORPORATION

2800H Bob Wallace Ave., Huntsville, AL 35805
 Phone: 205-534-0011 Fax: 205-534-0010

Inquiry 701.

CUSTOM KEYBOARDS AND TERMINALS

Engineering, Development and Production

- Point-of-Sale • Special purpose • Harsh environment
- Access control • Data collection • Operator input
- Unique • Industrial • Any interface, key style or size
- No minimum quantity required

GENOVATION, Inc.

17741 Mitchell North, Irvine, CA 92714
 (800) 822-4333 (714) 833-3355 FAX (714) 833-0322

Inquiry 702.

BAR CODE

Portable Reader

Simple, Powerful, Easy-to-use

- AA Battery Operated, with backup coin battery
- 2 x 16 Supertwist LCD Display
- 32 Raised Rubber Keys
- Real-time Clock Built-In for Date/Time Stamps
- 2 Built-In Inventory Programs
- 3 User Defined Programs, & 3 User Data Files
- Wand, CCD, or Laser Scanner Input
- Doubles as Non-Portable Reader
- Serial Interface and Keyboard Interface
- Reads 2of5, UPC/EAN, 128, Code 39, etc.
- Uploads with furnished Programs or Xmodem
- 64K Complete with Steel Wand — \$799

Worthington Data Solutions

Swiss Office 3004 Mission Street
 Rütistrasse 6 Santa Cruz, CA 95060
 CH 9050, Appenzell Switzerland 408-458-9938
 071 87 51 17 FAX
 071 87 51 15 Phone **800-345-4220**

BAR CODE

Bar Code Readers

For PC, XT, AT, PS/2, Macintosh and Serial Terminals

- Attaches as 2nd Keyboard or to any ADB port
- Reads 2of5, 128, UPC/EAN, Code 39, etc.
- External or internal attachment on PC
- Wand, CCD, Slot Badge, Magstripe or Laser
- Two Scanners per Reader
- 100+ Configurable Options
- 2 Year Warranty, 30 Day \$ Back Guarantee
- Direct From Manufacturer
- Top Rated by Independent Review
- Complete with Laser Scanner — \$1399
- Complete with Stainless Steel Wand — \$399

Worthington Data Solutions

Swiss Office 3004 Mission Street
 Rütistrasse 6 Santa Cruz, CA 95060
 CH 9050, Appenzell Switzerland 408-458-9938
 071 87 51 17 FAX
 071 87 51 15 Phone **800-345-4220**

Labeling Software

On EPSON, IBM, OKI, or LaserJet. Easy WYSIWYG design. Any format/size. Up to 120 fields per label. 18 text sizes to 3" —readable at 100', ALAG, KMart, Sears, MIL-STD, Pennys, 2of5, 128, UPC/EAN, Code 39. File Input & Scanned PCX graphics — \$279. Other programs from \$129.

Worthington Data Solutions

(408) 458-9938 **800-345-4220**

BAR CODE READERS

Keyboard emulation for PC/XT/AT & PS/2s, all clones and any RS-232 Terminal. Transparent to your operating system. Available with Steel wands, Lasers, Slot & Magstripe Readers. Same day shipping. 30-day money-back guarantee. One-year warranty. Reseller discounts available.

AMERICAN MICROSYSTEMS

2190 A Regal Parkway, Eulless, TX 76040
 (800) 648-4452 (817) 571-9015 FAX (817) 685-6232

PORTABLE BAR CODE READER

Battery operated, handheld reader with 64K RAM, 54 key keyboard, real-time clock, 2X16 LCD display, and built-in calculator. Supports WAND, CCD, and LASER. Built-in program generator supports multiple programs and data files. Interfaces to PC & PS/2 keyboards. RS-232 terminals, and Hayes compatible modems. 30-DAY MONEY-BACK GUARANTEE.

AMERICAN MICROSYSTEMS

2190 A Regal Parkway, Eulless, TX 76040
 (800) 648-4452 (817) 571-9015 FAX (817) 685-6232

BAR CODE

BAR CODE PRINTING SOFTWARE

- MS/PC DOS Systems • Import/Export ASCII files • 9 & 24 pin dot matrix • H-P LaserJet/Plus/Series II
- Menu-driven or Memory Resident • Most Label Sizes • Multiple Densities • Variable Graphic Heights • Code 39, 12/5, UPC A/E, EAN 8/13, 128, 93, 11, MS1/PLESSEY, POSTNET (ZIP+4).

AMERICAN MICROSYSTEMS

2190 Regal Parkway, Eulless, TX 76040
 (800) 648-4452 (817) 571-9015 FAX (817) 685-6232

BAR CODE "SPECIALS"

- Wedges/Portables/Multi On-Line readers with HP wands
- Spectra-Physics lasers \$899. PSC & Symbol in stock
- 3" CCDs \$468. Mag stripe encoders/readers \$1485
- Software: print bar codes \$99 & read bar codes \$159
- P.O.S. — cash drawers \$199/receipt printers \$399...
- 30-day \$\$ Back / 1 Year Warranty *Spanish Dept. available
- OEM/VAR/Dealer discounts

BARCODE INTERNATIONAL SYSTEMS

9190 Palm Canyon Drive, Corona, CA 91719
 (714) 277-1917 • (800) 653-4252 • FAX: (714) 277-1005

Inquiry 703.

READ ZIP BAR CODES!

The Standard Edition of KNOW-WEDGE for CODE 39 Complete with Hewlett-Packard Wand.

ONLY \$149.00.

For alternative hardware or software solutions

CALL

COMPUTER RESOURCES GROUP

629 Silverdale Drive, Claremont, CA 91711
 VOICE: (714) 624-8734 BBS: (714) 626-1054

Inquiry 704.

I. T. S. Bar Code Solutions

Bar codes are easy using our FULL line of readers & printers. They plug and play with your existing CPU/printer/terminals/software systems in your office, store, truck, factory or warehouse. ITS' bar code DOS programs print on matrix or laser printers. 30 day refund. 1 year warranty. OEM/VAR/Dealer discounts.

International Technologies & Systems Corp.

655-K North Berry St., Brea, CA 92621 - Western USA
 13 Welwyn Court, Richmond, VA 23229 - Eastern USA
 (800) 228-9487 (714) 990-1880 (804) 741-6725 (FAX) 990-2503

Inquiry 705.

EASY BAR CODE PRINTING

The leader in PC Postal bar coding software now provides same easy & flexible barcoding for Code 39.

- ☐ **BARZ_OUT** — PC memory resident with easy menu select & load. Use with your current programs.
- ☐ **MAKE_BARZ** — Easy menu creation of bar code labels.

Save \$70 — Limited Time Offer — Both \$129
 30 day \$\$BACK (Call about UNIX, WINDOWS, Other Codes.)

POSTSAVER SYSTEMS

2731 S. Adams Rd. STE 102, Rochester, MI 48309-3103
 (800) 879-6820 (313) 299-5050 FAX (313) 299-5052

Inquiry 706.

BAR CODE

PC BAR CODE SPECIALISTS

Bar code readers designed for fast, reliable, cost-effective data entry. They emulate your keyboard, so data looks just like it was typed in! Choose from stainless steel wand, laser gun, CCD, and magnetic stripe scanners. Also, powerful label printing software. Great warranty. Generous reseller discounts. 30-DAY MONEY-BACK GUARANTEE.

Seagull Scientific Systems

15127 N.E. 24th, Suite 333, Redmond, WA 98052
1-800-758-2001 206-451-8966

DATA INPUT DEVICES

Bar Code, Magnetic Stripe Readers & SmartCard Encoder/Reader for microcomputers & terminals, including IBM PS/2 & others, DEC, Macintosh, AT&T, CT, Wyse, Wang. All readers connect on the keyboard cable & are transparent to all software. UPC & 39 print programs, magnetic encoders, & portable readers are also available.

TPS Electronics

4047 Transport, Palo Alto, CA 94303
415-856-6833 Telex 371-9097 TPS PLA
1-800-526-5920 FAX: 415-856-3843

Inquiry 707.

VARIANT MICROSYSTEMS

BAR CODE READERS DELIVER

- WAND/LASER/MAGNETIC CARD CONNECTIVITY
- Keyboard wedges (Internal/External) for IBM PC/XT/AT, PS/2, and portables
- RS232 wedges for WYSE, Link, Kimtron terminals
- Bar code and label printing software
- Full two-year warranty
- 30-Day Money-Back Guarantee
- Extensive VAR/Dealer Discounts

46560 Fremont Blvd., Suite 206/Fremont, CA 94538/(510) 440-2870
800-666-4BAR FAX: (510) 440-2873

Inquiry 708.

CAD

PCB & SCHEMATIC CAD-\$195

"EASY-PC" for single-sided and multilayer boards to 17"x17" with up to 1500 ICs including surface mount. Phenomenally fast and easy to use. Over 13,000 copies sold. Needs PC/XT/286/386 HERC/CGA/EGA/VGA. Output to laserjet/inkjet/dot matrix printer, pen-plotter, photo-plotter and NC Drill. Not copy protected. VISA/MC/AMEX welcome. For full info circle inquiry # or contact us directly.

NUMBER ONE SYSTEMS LTD.

Harding Way, St. Ives, Huntingdon, Cambs, England, PE17 4WR
Tel: 011-44-480-61778 Fax: 011-44-480-494042

Inquiry 709.

CAD/CAM

CONTOURING MOTION CONTROL

FROM A PRINTER PORT!

NEW Indexer LPT™ software **\$249**
VERSION 3 VISA/MC

- Controls up to six step motors simultaneously.
- Linear and Circular Interpolation.
- New features to accommodate machine control.
- Easy-to-use DOS device driver. Super Manual.
- CAD-CAM interface available.

Ability Systems

Corporation, 1422 Arnold Ave.
Roslyn, PA 19001 (215) 657-4338
FAX: (215) 657-7815

Inquiry 710.

COMMUNICATION-VOICE/FAX

FAX-ON-DEMAND For ONLY \$550!

VOICE & FAX HARDWARE & SOFTWARE for 286+PC computers! Includes 23 sample applications, plus ability to create custom multiline voice/fax/data-base programs! Used by developers worldwide. Supports Rhetorex & Dialogic. Call About DAX!

RAM RESEARCH

1920 Monument Blvd., #159, Concord, CA 94520
Voice: (510) 603-1122 Fax: (510) 603-1125

Inquiry 711.

CD-ROM

Simtel MSDOS Shareware

CDROM, 640 Meg, Dec. 92.....\$24.95

CICA MS Windows Shareware

CDROM, Nov. 92.....\$24.95

OS/2 Shareware

CDROM, Nov. 92.....\$24.95

Source Code

CDROM, 600 Meg, Mar. 92.....\$39.95

INFO-MAC

Macintosh SW,
4000+ files, Aug. 92.....\$39.95

CDROM Caddies.....\$4.95

WALNUT CREEK CDROM

1547 Palos Verdes Mall, Ste 260, Walnut Creek, CA 94596

(800) 786 9907

(510) 947 5996

FAX: (510) 947 1644

Inquiry 712.

COMMUNICATIONS

X.25, HDLC, SDLC, BSC

SDLA card and software provides 'plug-in' synchronous link support for PCs which is inexpensive, easy to use and robust. Coprocessor architecture ensures reliable communications under any operating system at line speeds to 180kbps. Packages include protocol analyser, test and development software. OEM enquiries welcome.

Full function SNA emulation packages also available.

Sangoma Technologies Inc.

(416) 474-1990 1-800-388-2475

Inquiry 713.

COMPUTER BOOKS

COMPUTER BOOKS at a discount

- We specialize in ADVANCED books for developers, programmers, computer professionals, engineers, and academics
- Windows, C++, O/S2 2.0, UNIX, Mac, OOP, Analysis/Design, AI, Neural Nets
- 15% discount on any quantity
- Personal service from our computer literate staff
- CD-ROM Books in Print lookup service
- Special orders, hard-to-find books
- Latest books from over 70 publishers
- Free 16-page catalog
- UPS domestic & international shipping
- CompuServe® 70007,1333, GO CBK
- Internet 70007.1333@compuserve.com

CompuBooks

800-880-6818
Rt. 1, Box 271-D 512-321-9652
Cedar Creek, TX, 78612 Fax 321-4525
USA MC/Visa/AmEx/Disc

Inquiry 714.

COMPUTER INSURANCE

INSURES YOUR COMPUTER

SAFWARE Computerowner's coverage provides replacement of hardware, media and purchased software. As little as \$49 a year covers accidents, theft, power surges and more. One call does it all.

TOLL FREE 1-800-848-3469

SAFWARE, The Insurance Agency Inc.

PO Box 02211, 2929 N. High St., Columbus, OH 43202

Inquiry 715.

COMPUTER SYSTEMS

LOW-LOW-LOW

Computer Systems

Notebooks • Network Solutions

IBM-Apple-Compaq-

AST-ALR-Everex-&others

SURAH 386/486 ISA/EISA

AMI/Mylex Motherboards

- CD ROMS
- Tape Backup
- Pocket FAX Modem LAN Cards
- Hard Drives/Floppy Drives
- Memory/upgrades
- DRAMS, SIMM Modules
- Laser Printers/Scanners
- Plotters & Digitizers
- Software

44912 Osgood Road,
Fremont CA 94539 USA
Phone: (510) 651-5101
Fax: (510) 651-5241

SURAH inc.

1-800-543-1001 Nationwide Orders

Inquiry 716.

CROSS ASSEMBLERS

PC BASED DEVELOPMENT TOOLS

We offer low-cost efficient CROSS ASSEMBLERS and a superb line of SIMULATOR-DEBUGGERS with full built-in DISASSEMBLERS for Intel's MCS-48, 51, 85 and 96, and for the 280 families of embedded controllers. Our new simulators for the 80C196KB and 80C196KC are unique in the market, and have been received with rave reviews. The price of our software includes unlimited free upgrade privileges!

Lear Com Company

2440 Kipling St., Ste. 206, Lakewood, CO 80215
(303) 232-2226 FAX (303) 232-8721

Inquiry 717.

Cross Assemblers \$50

Simulators \$100

Disassemblers \$100

PseudoCorp

716 Thimble Shoals Blvd. Newport News, VA 23606
(804) 873-1947 Fax (804) 873-2154

Inquiry 718.

DATA CONVERSION

TAPE CONVERSION & DUPLICATION

- DC2000
- 1/4" Cartridge (AS/400)
- TEAC
- 4mm DAT
- 8mm EXABYTE
- DEC TKxx media
- 1/2" Tape
- 3480 & 3490

Mainframe, Mini or Micro - popular or obscure.
Fixed price quote by return. Standard turnaround 24 Hours.
TEL 1 800-392-5373 FAX: 405-321-2741

TEL 44+ (0) 734-890042 FAX: 44+ (0) 734-890040
Vogon Enterprises Ltd.

Unit 5, Forrest Court, Oaklands Park, Fishponds Road,
Wokingham, Berks., RG11 2FD, England

Inquiry 719.

DATA RECOVERY

Ontrack DATA RECOVERY

- Unsurpassed success rate • Fast turn around
- Priority service available • Clean room
- Expertise in DOS, OS/2, Novell, Macintosh, Unix, Xenix, Wang, DEC, Wang, Banyan Vines and more!

MN:1-800-872-2599 • CA:1-800-752-7557

6321 Bury Drive, Eden Prairie MN 55346
2400 Main Street, Suite 200, Irvine CA 92714

Inquiry 720.

THE BUYER'S MART

DATA RECOVERY

Now we're ONTRACK in London Too.

ONTRACK DATA RECOVERY
EUROPE, LTD.

Surrey House, 34 Eden St., Kingston upon Thames, Surrey KT1 1ER U.K.
0800-24-39-96 • 44-81-974 5522

Inquiry 721.

TAPE DATA RECOVERY

- DC2000
- TEAC
- 8mm EXABYTE
- 1/2" Tape
- 1/4" Cartridge (AS/400)
- 4mm DAT
- DEC TKxx media
- 3480 & 3490

Whatever the Hardware, Software & Problem...
if there is data on a tape we will recover it.

TEL 1 800-392-5373 FAX: 405-321-2741
TEL 44+ (0) 734-890042 FAX: 44+ (0) 734-890040

Vogon Enterprises Ltd. *

Unit 5, Forrest Court, Oaklands Park, Fishponds Road,
Wokingham, Berks., RG11 2FD, England

Inquiry 722.

DATA/DISK CONVERSION

CONVERTING YOUR DISKETTES? ENTRUST THEM TO US!

2500 Word Processor & Computer formats,
3 1/2", 5 1/4", 8" Disks, Mag Tapes, Mag Cards, Cartridges,
Cassettes & 8 MM Custom Conversions, Programming
& Applications Development

DISK DUPLICATION

OCR SCANNING SERVICES

Call us for Quality, Best Prices and Quickest Turnaround Time.

COMPANY COMPENDIA, INC., 55 E. Washington St., #237
Chicago, IL 60602 TEL: 1-800-374-DISK FAX: 312-419-1390

Inquiry 723.

THE #1 CHOICE in disk & tape conversion

for many leading corporations, government agencies,
law firms, and companies in every industry—world-wide.

Free test • Satisfaction guaranteed

Graphics Unlimited Inc.

3000 Second St. North, Minneapolis, MN 55411
(612) 588-7571 FAX: (612) 588-8783
1-800-745-7571

Inquiry 724.

CONVERSION SERVICES

Convert any 9-track magnetic tape to or from over
5000 formats including 3 1/2", 5 1/4", 8" disk formats &
word processors. Disk-to-disk conversions also
available. Introducing CD-ROM conversions. Call
for more info.

Pivar Computing Services, Inc.

165 Arlington Hgts. Rd., Dept. #B
Buffalo Grove, IL 60089 (800) Convert

DATABASE

THE NERD SHOP
FOR
SUPERBASE 2
800-448-NERD

Inquiry 725.

DIAGNOSTIC

"..PINPOINT ANY PC FAILURE."

John C. Dvorak, PC Magazine 6/30/92

Top-rated PocketPOST Power On Self-Test card with
diagnostic software for ISA/EISA/Micro-
Channel. 180-page book. Hones your trouble
shooting skills. CALL NOW.

DATA DEPOT, Inc.

1710 Drew Street #5, Clearwater, FL 34615

1-800-275-1913

813-446-3402 FAX 813-443-4377

Inquiry 726.

DISK DRIVES

21MB 3.5" Floptical Disk Drive for \$399!

EchoDrive SCSI Floptical disk drive not only reads and
writes to 21MB 3.5" Floptical diskettes but also:

- reads and writes to 720K and 1.44MB floppy diskettes
- runs under DOS, Windows, or on the Macintosh
- is available as an external or internal drive
- provides amazing floppy speed! WOW!
- It's GREAT for backup, file archival, and transporting files.

Second Wave, Inc. • 9430 Research Blvd. II-260

Austin, TX 78759 • (512) 343-9661 • FAX: (512) 343-9663

Inquiry 727.

EDUCATION

B.S. & M.S. In COMPUTER SCIENCE

The American Institute for Computer Sciences offers an in-
depth correspondence program to earn your Bachelor of
Science and Master of Science degrees in Computer Science
at home. B.S. subjects covered are: MS/DOS, BASIC,
PASCAL, C, Data File Processing, Data Structures &
Operating systems. M.S. program includes subjects in
Software Engineering and Artificial Intelligence.

AMERICAN INST. for COMPUTER SCIENCES

2101-BY Magnolia Ave. South, Ste. 200, Birmingham, AL 35205

800-767-2427 205-323-6191

Inquiry 727.

ELECTRONIC MAIL

ELECTRONIC MAIL—Novell MHS

- Stand alone computers, Laptops, Netware, Lantastic
- Set up your own hub
- International network
- Workgroups, privacy, use your regular phone line
- \$100.00 per computer station — unlimited phone
support and design assistance.

Selections & Functions, Inc.

Call for a brochure (617) 826-1553

25 Washington Street, Hanover, MA 02339

Inquiry 724.

FINANCIAL SOFTWARE

BrainMaker:

"The most fascinating computer
software I've ever seen...learn
about this stuff."

John Dvorak, PC Mag.

Predicts stocks, bonds, sales, in-
ventories. Comprehensive manual.
Menus. 12,000 sold. PC or Mac.

Still only \$195!

Free Flyer: 800/284-8112, 916/477-7481

California
Scientific Software

Inquiry 728.

FLOW CHARTS

WINDOWS FLOWCHARTER \$129

RFFlow 2.0 is a professional drawing tool for
flowcharts & org. charts. Requires Microsoft Win-
dows. 100 shapes auto adjust in size. Diagonal
lines and curves. Auto line routing and re-routing.
Click on a shape to bring up a sub-chart. Move
charts to other apps. via the Clipboard. Call for free
trial disk.

RFF ELECTRONICS

1053 Banyan Court, Loveland, CO 80538

Phone: (303) 663-5767 FAX: (303) 669-4889

Inquiry 729.

FRAMEWORK/FRED

The Framework Magazine

Framework enhancement programs, 12 issues \$29.90
Unlimited Framework and FRED support. Access
undocumented powers of Framework & FRED.

fBase for Framework \$190.90

The fastest disk database access in existence. dBase file
index optimization and compression.

Selections & Functions, Inc.

(617) 826-1553

25 Washington Street, Hanover, MA 02339

Inquiry 729.

G.I.S.

Digital Quad Maps

Local Street Maps, State Maps, and World
Maps in DXF, PCX, PICT, PIC or TIF
Formats. Gigabytes of Map data available.

Micro Map & CAD™

(303) 988-4940

Inquiry 729.

GRAPHICS

THE NERD SHOP
FOR
HARVARD GRAPHICS
800-448-NERD

Inquiry 730.

Sirlin's CAD ++ ENGINE

- Read and Write AutoCAD DWG and DXF files.
- Object oriented, modular, database-like access
to CAD data.
- View, Print (rasterize), Plot (vectorize), and
Pick (interact) modules.
- Available for C/C++ for DOS, Extended DOS,
Windows, Sun and other Unix systems.

Sirlin Computer Corporation

25 Orchard View Dr., Ste 14, Londonderry, NH 03053
Phone: (603) 437-0727 • Fax: (603) 437-0737

Inquiry 731.

GRAPHICS SOFTWARE

3D RenderLib for Windows

3D Graphics Dynamic link library

— More than 300 functions callable from MSC and BC++
— Wireframe, Flat, Phong and Gouraud shading — Renders in any
window or creates own windows — Unlimited number of colored
Point, Direction and Spot lights — Clipping planes and Double-
buffering — Hierarchical object oriented data storage — 350 pages
long manual.

\$450.00 (\$1450.00 royalty free distribution)

3rd Floor Graphics Software

P.O. Box 4105, 9701 EC Groningen, The Netherlands
fax: (+31) (0)50 184190

Inquiry 732.

HACKING/SECURITY

BLACK BOOK ON HACKING AND SECURITY

- All new 1993 edition
- Includes many expert tricks and techniques you can try
- The "How to" do it and prevent it book
- You will be surprised to see how vulnerable systems are!

Fast delivery!

Send only \$25 U.S. check or money order to:

NYTEK INNOVATIVE COMMUNICATIONS

P.O. Box 2753, Station C

Ottawa, Ontario (Canada) K1P 5W8

Inquiry 733.

HARDWARE

Pre-Owned Electronics, Inc.TM

THE Independent Provider, serving the Dealer, Professional, Corporate, Government, and Educational Buyer since 1985

**APPLE II® & MACINTOSH®
SYSTEMS • PARTS • EXCHANGE REPAIRS**

Call for a Catalog... **800-274-5343**

INT'L: 617-275-4600 • FAX: 617-275-4848

205 BURLINGTON ROAD • BEDFORD, MA 01730

Inquiry 734.

HEWLETT PACKARD

Buy - Sell - Trade

LaserJet ColorPro
DeskJet DraftPro
RuggedWriter DraftMaster
Electrostatic Plotters

• Monochrome and Color

HP 9000 Workstations and Vectras also available.

T. E. Dasher & Associates

4117 Second Ave., S. Birmingham, AL 35222

Phone: (205) 591-4747 Fax: (205) 591-1108

(800) 638-4833

Inquiry 735.

HARDWARE/COMPUTERS

SC/FOXTM EMBEDDED COMPUTERS

PC Parallel Coprocessor Plug-In Boards: 15 MIPS avg 30 MIPS burst, using the SC32 32-bit CPU or the 16-bit Harris RTX 2000TM.

VME Master/Slave System Controller SBC: 18 MIPS avg 70 MIPS burst, uses RTX 2000 cpu, SCSI, 2 ser, 1 ppr ports, to 640K bytes.

Stand-Alone Single Board Computers: 18 MIPS avg 60 MIPS burst, 3U or 100x100mm Eurocard-size using either SC32 or RTX 2000.

Ideal for embedded real-time control, data acquisition, robotics, and signal processing. OEM software development system included.

SILICON COMPOSERS INC (415) 322-8763

208 California Avenue, Palo Alto, CA 94306

Inquiry 736.

INDUSTRIAL SOFTWARE

Industrial Automation Products

We produce TRUE industrial products such as: PCs, acquisition add-on cards, embedded controllers and software. Call for our FREE full-line catalog.

**ELSIST
Electronic Systems**

Via Brodolini, 15, 15033 Casale MTO, ITALY
Ph. 142/451987 FAX 142/451988 BBS 142/453165

Inquiry 737.

JAPAN MARKET

Seek Software Developers

We are looking for companies developing competitive software products for PCs and aggressively wishing to enter Japan market. Enormous Japanese PC software market attracts worldwide attention. Do not worry about even though you are unfamiliar with Japan market or do not have well organized sales network in Japan. Our technical engineer is pleased to help you by modifications for Japanese PCs. If your company deserves our considering, please feel free to fax us today for details. Product catalogs and company profile are highly welcome.

Giken Shoji Co., Ltd.

Fax: 81-052-972-6577 Phone: 81-052-972-6544
6F Soar Bldg, 2-3, 1-chome, Izumi, Higashi-ku, Nagoya 461, Japan

Inquiry 738.

LANs

The \$25 Network Try the 1st truly low-cost LAN

- Connect 2 or 3 XT's, AT's, 386's, 486's
- Uses serial ports and null modem cable
- Runs at 115K baud - approx 8500 bytes/sec
- Runs in background, totally transparent
- Share disks and printers, etc.
- Needs only 15K of RAM

Little Big LAN

The most flexible network

- Peer to Peer LAN to 250 nodes
- \$75 total software cost, not per node!
- Link via serial, parallel, or Arcnet
- Link via Ethernet or Modems soon
- Mixed mode routing
- Typically only 35K of RAM

Skeptical? We make believers!

Information Modes

P.O. Drawer F, Denton, TX 76202

Tech 817-387-3339 Orders 800-628-7992

Hours 1-5 Mon/Wed, 9-5 Tue/Thu/Fri CST

Inquiry 739.

LANLINK PROFESSIONAL * PC-MOS

- * Use ethernet and/or serial/parallel ports for LAN connections
- * Connect DOS, Windows & PC-MOS clients & servers
- * Share one PC with up to 33 users with PC-MOS multiuser DOS
- * LAN as low as \$99 per node, PC-MOS as low as \$33 per user

THE SOFTWARE LINK

3577 Parkway Lane, Norcross, GA 30092

1-800-766-LINK * (404) 448-5465

Inquiry 740.

LAPTOP COMPUTERS

USED COMPUTERS

MAJOR BRANDS - WIDE SELECTION
IBM - COMPAQ & OTHERS

Computers from \$99 Color Printers \$199
Mono Monitors from \$25 CGA Color Monitors \$129

IBM 5140 LAPTOP \$349

IBM PCjr & CONVERTIBLE PARTS & ACCESSORIES

HARD-TO-FIND ITEMS FOR OLDER PCS

**FREE CATALOG
COMPUTER RESET**

P.O. Box 461782, Garland, TX 75046

Phone (214) 276-8072 & FAX BBS (214) 272-7920

Inquiry 741.

LOCALIZATION

Software Developers! Localization Managers!

Now you can manage software translation more efficiently and simply with IDOC's new software

XL8TM

- Lower translation cost
- Faster time to market
- Consistency across releases
- Localize on any platform

Call for a FREE demo disk

1-800-336-9898, ext XL8

IDOC, An International Documentation Company

Inquiry 742.

LAPTOP PERIPHERALS

Toshiba Serial Cards

- D and E modem slots, DB9 or RJ11/12 connector, RS232C-\$199; RS422C-\$249
- A slot, DB9 with 2400bps modem, RS232C-\$199; RS422C-\$249
- A slot, Dual RS232C-\$249
- A slot, SCSI host adapter - \$249
- Designed and made in USA!!

Custom design capability. Auto adapters for various laptops, notebooks, and printers.

EMPIRE ENGINEERING

California USA

tel 805/543-2816

fax 805/543-2820

Inquiry 743.

OPTICAL STORAGE

OPTICAL DISKS

WE STOCK ALL BRANDS OF OPTICAL MEDIA

We Also Carry Optical Drives,

DAT & 8mm Products

★ ★ CORPORATE DISCOUNTS ★ ★

CITY COMPUTER & SUPPLIES

271 Schrop Avenue, Akron, Ohio 44312

1 (800) 759-6868 (216) 784-4464

FAST NEXT DAY UPS

Inquiry 744.

PROGRAMMERS TOOLS

INCORPORATE SOUND BLASTER & ADLIB INTO YOUR SOFTWARE

The WORX programmers toolkit will allow you to easily incorporate sound and music into your software without having to struggle with low level code and compatibility problems. Plays back standard MIDI files and VOC sample files fully in the background. This toolkit is a linkable library which takes less than 32K of code, and requires no driver or TSR. Autodetects Sound Blaster configuration. No royalties, and updates are always free. WORX 1.6 for Turbo C, Pascal and Microsoft C: \$49 Resource manager for WORX (C only): \$29

MYSTIC SOFTWARE

1504 Encinal Avenue, Ste D, Alameda, CA 94501

Voice: (510) 865-9189 Demos/BBS: (510) 865-3856

Inquiry 745.

Boost Your BASIC with ProBas!

- ☞ ProBas5 adds 938 new commands to QB/QDS
- ☞ Written in assembly for speed
- ☞ Gives your programs a professional look
- ☞ Easy to use, money back guarantee, \$195
- ☞ Other add-ons for BASIC, C & Visual Basic avail.

FREE DEMO Disk AND BOOKLET

TeraTech (800) 447-9120 x1002

Dept 1002, 100 Park Ave., Suite 360, Rockville, MD 20850

Int'l +1(301) 424-3903 Fax (301) 762-8185 BBS (301) 762-8184

Inquiry 746.

Structograms

Software Documentation made quick and easy with PANORAMA

- Structograms (Nassi-Shneiderman) automatically from the source code in a flash
- Hierarchie-trees of modules, procedures
- Headers of modules, procedures
- Software-Metrics: McCabe complexity, LOC and more

Available for: Turbo Pascal, C, Modula-2, Fortran-77, PL/M, dBase

PANORAMA Standard (Pascal, C, Modula-2): \$495

PANORAMA Lite: \$295 **Wuest Informatik AG**

Schuetzenstrasse 11; CH-8245 Feuerthalen; Switzerland

Int'l (+41 53) 29 31 32 FAX: (+41 53) 29 31 43

Call or Fax for information and free demo.

Inquiry 747.

YOUR SALES MESSAGE

about the special computer product or service that you provide belongs in print

THE BUYER'S MART

can help you reach computer professionals and produce valuable inquiries for your company!

Call **Margot Gnade** for more information

603-924-2656

or

Fax: 603-924-2656

Inquiry 748.

THE BUYER'S MART

PROJECT BILLING

CLIENT PROJECT

A Time and Billing System that accounts for charges to an unlimited number of projects (*or matters*). Price with limited time discount, \$129. Demo available.

MICRO BILLING SYSTEMS, INC.

117 W. Harrison, Ste# 624M, Chicago IL 60605
Tel: (312) 939-1869 Fax: (312) 939-1351

Inquiry 749.

SECURITY

FIGHT PIRACY!

★ EVERLOCK 3.0 ★

SOFTWARE COPY PROTECTION

New Option Board Safe-New Remote Registration
New CPU LOCK-CD ROM LOCK and more

★ EVERKEY HARDWARE LOCKS ★

Az-Tech Software, Inc.

Call for a 201 East Franklin, Richmond, MO 64085
FREE (816) 776-2700
Demo (800) 227-0644 FAX (816) 776-8398

Inquiry 750.

THE ULTIMATE SOFTWARE SECURITY

- STOPCOPY family - UNCOPIABLE copy protection
- STOPVIEW software encryption
- NETLIMIT network license metering
- DOS, Windows, Macintosh, OS/2, support
- No source code changes required - for ANY of our products in ANY environment
- Our products destroy ALL of our competition
- Call for FREE demo disk, or to discuss our products' MANY options

BBI Computer Systems, Inc.

14105 Heritage Lane, Silver Spring, MD 20906
800/TRY-ABBI • 800/879-2224 • 301/871-1094 • FAX: 301/460-7545

Inquiry 751.

Cop's CopyLock II

The professional software protection with TRUE Machine Install. Option Board safe. OS/2, Networks, Windows, and Trace 1020.

LINK Computer

Int'l: + 45 31232350 Fax: + 45 31238448
US/CAN: 800-344-2545 FAX: 408-923-7061

BIT-LOCK® SECURITY

Piracy SURVIVAL 10 YEARS proves effectiveness of powerful multilayered security. Rapid decryption algorithms. PARALLEL or SERIAL port-transparent security device. Complemented by economical KEY-LOCK™ and multifunctional COMPU-LOCK™ including countdown, timeout, data encryption, and multiproduct protection. (Dos/Unix/Mac). Also, access control.

MICROCOMPUTER APPLICATIONS

3167 E. Otero Circle, Littleton, CO 80122
(303) 770-1917

Inquiry 752.

SHAREWARE

NEW NEW NEW

Rocket "93" HQ CD ROM

600 megs of High Q. Shareware \$39.95+
Latest Shareware on floppies \$1.98 ea.+

Lowest Prices - Highest Quality
Catalog Available

ROCKET SHAREWARE

1-612-934-4775

Inquiry 753.

SHAREWARE

FREE SOFTWARE FOR IBM®/CLONES

Try us! Get 5/5.25" or 3/3.5" disks full of the latest software - FREE! Choose from General Interest, Games, Windows®, Kid's, Clip Art or Fonts. Pay only a small service charge of \$2.95 per package. Credit Cards only. CALL TODAY!

SOFTWARE OF THE MONTH CLUB

(619) 931-8111, EXT. 511

Inquiry 754.

SOFTWARE/ACCOUNTING

dBASE BUSINESS TOOLS

- GENERAL LEDGER
- ORDER ENTRY
- JOB COSTING
- BILL OF MATLS
- PAYROLL
- PURCH ORD/INVENTORY
- ACCOUNTS REC/VABLE
- JOB ESTIMATING
- SALES ANALYSIS
- ACCOUNTS PAYABLE

\$99/\$198 ea. + S&H

DATAMAR SYSTEMS Cred. Card-Check-COD

6969-D Corte Santa Fe, San Diego, CA 92121
(619) 452-0044 (800) 223-9963

Inquiry 755.

SOFTWARE/BUSINESS

DATA ENTRY SOFTWARE

Full featured, heads-down data entry with two-pass verification, edit language, operator stats, much more! Designed for the PS/2®, PC, XT, AT or compatibles.

PCs from \$395 LAN version available

FREE 30 day trial

Computer Keys Tel: 206/776/6443
21929 Makah Rd., Fax: 206/776-7210
Woodway, WA 98020 USA: 800/356-0203

Inquiry 756.

SOFTWARE/ENGINEERING

Mixed Mode Simulation

- NEW IsSPICE 3 with Analog/Digital simulation
- Draws waveforms as the simulation runs
- PC and Macintosh Versions
- Filter Design
- Schematic Entry
- Extensive Model Libraries
- Waveform Analysis
- Full SPICE programs starting at \$95. Complete systems from \$990.

Call for your Free Demo and Information kit.
P.O. Box 710, San Pedro, CA 90733-0710
310-833-0710, FAX: 310-833-9658

intusoft

Inquiry 756.

SAUNA: 3D THERMAL ANALYSIS

- Models: PCBs, plates, heatsinks, enclosures, multiboard enclosures. • All heat transfer modes: convection, radiation, conduction • Interactive menu-driven • Thermal parameters library • Fast "what if": dimension, mat'l, finish, analyses • Easy to learn & use • IBM PC & Macintosh II

Call for free evaluation program

Tatum Labs, Inc.

1287 N. Silo Ridge Drive, Ann Arbor, MI 48108
313-663-8810

Inquiry 757.

SOFTWARE/GRAPHICS

TIFF, PCX, TARGA, GIF, DIB, BMP, DCX, EPS, WMF, WPG, PICT, JPEG AccuSoft Image Format Library 3.0

"The most comprehensive raster support library on the market" Import, export, convert, display, and print all above formats! DOS & Windows versions included in one package. No royalties. Includes several sample programs with source code. Supports all languages. Format compatibility guaranteed! G3, G4, TIFF-f, multi-page images etc. Rotate, scale, color reduction, sharpen etc. 30 day satisfaction guarantee. \$495

AccuSoft Corporation

160 E. Main St., P.O. Box 1261, Westboro, MA 01581
(800) 525-3577 (508) 898-2770 FAX (508) 898-9662

Inquiry 758.

SOFTWARE/GRAPHICS

Develop CAD/CAM, GIS, A/E/C Products

ON TIME and UNDER BUDGET with the "CAD/CAM Developer's Kit" Series

The CCDKs are libraries of C functions which support routines for DXF input/output, graphical display, line/arc/ellipse/NURB spline construction/editing, and much more than can be described here.

Building Block Software, Inc.

371 Moody Street, Waltham, MA 02154
Voice (617) 899-4350 Fax (617) 899-4399

Inquiry 759.

"The Ultimate CAD/CAM/CAE Programming Engine"

Slash your development time, with your CAD programming companion, TG-Professional v.4.0, the most complete C/C++ toolbox of 2D & 3D geometric routines available today! Over 800 routines including NURBS, DXF, Graphics, Surfacing, Hidden Line, Transforms, Perspectives, Polygon (Int/Union/Diff), Clipping, Tangents and more. Routines for drawing using BGI or MSC Graphics. Full source & 30 day guarantee. USA \$500.00. Use MSC, Borland C/C++, WATCOM C/386 or Metaware High C/C++. Call 1-800-635-7760 or Fax/Phone 214-423-7288 for free 30 page technical paper.

Disk Software Inc.

109 S. Murphy Rd., Plano, TX USA 75094

Inquiry 759.

SOFTWARE/GUI

GUI TOOLKIT ONLY \$249

Full source code included

TEGL Windows Toolkit lets you create DOS based GUI apps that are completely standalone. Over 500 functions. Menus, mouse & keyboard support, dialogues, and more. Includes TEGL graphics interface which has drivers for most popular video modes. Supports most C and Pascal compilers. Protected mode version is only \$499. No royalties.

TEGL Systems Corporation

P.O. Box 580, Stn. A, Vancouver B.C. V6C 2N2
(604) 669-2577 FAX (604) 688-9530

Inquiry 760.

SOFTWARE/MATHEMATICS

GEOMETRY/TRIGONOMETRY CALCULATOR

Apollonius - Sketch-based geometry/ trigonometry solver. State-of-the-art variational geometry system lets you sketch your geometry or trig problem and automatically solves for distances, angles and areas. Integrated equation calculator, graphs and tables plus DDE and clipboard support. Ideal for surveyors, engineers, machine shops, students, architects, or anyone who uses trig. Runs under MS Windows 3.0 \$98

Saltire Software 1-800-659-1874

Inquiry 761.

SOFTWARE/PACKAGING

FREE SOFTWARE PACKAGING CATALOG

Everything you will need to Package, Distribute, and Ship Your Software! From manuals and binders to mailers and shippers

LABELS • LABELS • LABELS

For your diskettes, plain or custom printed dot matrix or laser printer... free samples

...FREE CATALOG...

Hice & Associates

8586 Monticello Dr., West Chester, OH 45609

Phone/Fax: 513-777-8586

Inquiry 762.

STOCK PACKAGING

to help you

market your software

ask for catalog 92 S

Call 708 390-7744

or fax 708 390-8886

PolyQuick Co.

1243 Rand Road, Des Plaines, IL 60016

Inquiry 763.

SOFTWARE/SCIENTIFIC

COOK EXCEL SPREADSHEETS

XSolver optimizes spreadsheet models using simulated annealing. It can find global minima of functions of many variables even when multiple local minima exist. Requires Windows 3.x and Microsoft Excel 4.0 for Windows. Only \$150.

Exatech Software

6547 N. Academy Blvd., Suite 527, Colorado Springs, CO 80907
(719) 599-8727

Inquiry 764.

Volume Visualization

VoxelBox is a volume renderer for Windows. Volume rendering is the most direct method of visualizing 3D data. VoxelBox is fast, powerful and easy to use. It features raytracing, color/alpha mapping, lighting, keyframe animation support and much more. Price \$495

Jaguar Software, Inc.

573 Main St., Suite 9B, Winchester, MA 01890
(617) 729-3659

Inquiry 765.

NEW! MathViews™ for Windows

MATLAB compatible interpreter for Windows

- Matrix and Array Algebra
- Complex Numbers and Signal Processing
- 2D and 3D Graphics with Clipboard Support
- Written in C++ / Available for OEM
- Introductory Price \$495.00

The MathWizards

(619) 457-2971 FAX (619) 458-5849

Trademarks are the properties of their respective owners.

Inquiry 766.

VTX Scientific Desktop Publishing

• Equations • Tables • Graphics • Scalable Fonts • Supports most printers • WYSIWYG previewer • Foreign Languages • Special Symbols • Font Effects • Indices • Only \$299

"TeX of Tomorrow"—Notices of AMS, March 1991.

Call now for a **FREE DEMO DISK**

MicroPress, Inc.

68-30 Harrow Street, Forest Hills, NY
Tel (718) 575-1816 Fax (718) 575-8038

Inquiry 767.

SOFTWARE/SORT

OPT-TECH SORT/MERGE

Extremely fast Sort/Merge/Select utility. Run as an MS-DOS command or CALL as a subroutine. Supports most languages and file types including Btrieve and dBASE. Unlimited file sizes, multiple keys and much more! MS-DOS \$149. OS/2, XENIX, UNIX \$249.

(702) 588-3737

Opt-Tech Data Processing

P.O. Box 678 - Zephyr Cove, NV 89448

Inquiry 768.

SOFTWARE/VOICE/FAX

MULTI-VOICE® TOOLS

Multi-Voice Tools is a complete development Toolkit for Pascal or "C" to access all the features for most speech processing boards available today. It helps you write MULTI-VOICE APPLICATION systems in minutes. A number of programming examples are provided. All programs and libraries are delivered with source code.

Dialogic, Rhetorex, Pika, VBX: \$599. Watson (Single Line): \$99. ALSO AVAILABLE: Fax Programmer's Toolkit (\$199). Based on CAS specifications. Visa/MC accepted.

ITI Logiciel

4263 Cristophe-Colomb, Montreal, Quebec, Can. H2J 3G2
TEL (514) 597-1692 FAX (514) 526-2362

STATISTICS

The AIM Estimator™ Outperforms Neural Nets & Regression!

AIM combines the best of neural nets & regression to automatically learn polynomial networks that ESTIMATE or PREDICT any numeric value, such as: prices, probabilities, fuzzy values, inventories, sensor readings, control settings, and costs. ANYONE can learn AIM within 30 minutes and quickly achieve more accurate results.

Order \$20 Demo Package Today!

AbTech Corporation

508 Dale Ave. Tel: 804-977-0686
Charlottesville, VA 22903 Fax: 804-977-9615

Inquiry 769.

NCSS 5.x Series - \$125

Easy-to-use menus & spread sheet. Multiple regression. T-tests. ANOVA (up to 10 factors, rep. measures, covariance). Forecasting. Factor, cluster, & discriminant analysis. Nonparametrics. Cross Tabulation. Graphics: histograms, box, scatter, etc. Reads ASCII/Lotus. Many new add-on modules.

NCSS

329 North 1000 East, Kaysville, UT 84037

Phone: 801-546-0445 Fax: 801-546-3907

Inquiry 770.

PsychStat MAX 2.2 - \$59.95

Frequency • descriptives • chi-square • Fisher's exact test tests • multiple regression • weighted & unweighted ANOVAs correlation • repeated measures • intraclass corr • ANCOVA right-wrong & Likert item analysis • Cronbach's Alpha point-biserial • corrected item-total • coprocessor support ASCII • 25500 variables • satisfaction or money back.

PsychStat

1003 Justin Lane 2118

Austin, TX 78757 512-451-8152

Inquiry 771.

UTILITIES

FastTrax THE BEST DISK OPTIMIZER

- Defragments any size DOS disk incl. >1 Gb
- No limits on directories, files or clusters
- Unique in-cylinder method reduces seeks
- **MakeTrax** (incl.) for custom file placement
- Batch operation, power failure protection
- \$70, or \$40 for competitive upgrade, + S&H

FastTrax International

880 Ensenada Avenue, Berkeley CA 94707
24-hr Sales and Tech support (510) 525-3510

Inquiry 772.

PEN PLOTTER EMULATOR

FPLLOT turns your printer into an HP pen plotter. Fast hi-res, no jagged lines. Vary line width, color. Screen preview - zoom, pan. Works with most CAD programs. Supports most printers. Requires DOS 2.1 or higher. \$119+\$3 S&H. VISA/MC/Chk/MO.

FPLLOT Corporation

24-16 Steinway St., Suite 605, Astoria, NY 11103
718-545-3505

Inquiry 773.

VOICEMAIL/FAX

FAX-ON-DEMAND

Voice Mail System/Applications Generator

\$595

List price for complete Hardware/Software V-Mail and F.O.D. solution. Dealer inquiries welcomed. Voice/Fax/Modem card. Windows 3.1 application. Background operation. Intuitive GUI. Multi-level tree structure configured and displayed on screen. Configure for Auto-Attendant/Message Center. F.O.D/Information Center, message forwarding/paging, fax-scanner, voice/fax auto-detection, and much more. Call our F.O.D. line to receive more information instantly by fax.

Edens Technology Corp.

309 W. Beaufort, Suite 8, Normal IL 61761
TEL (309) 862-1704 FAX/F.O.D. Demo (309) 862-1804

Inquiry 774.

WINDOWS

HyperPhoto.db - A HyperImage/document management system under MS-Windows™ 3.x

Displays multiple windows of images and documents in true color or with color matching. Associates text info, images or symbols to any pixel inside an image. Easily switches from image to image through successive levels of detail. Finds a point inside an image by entering its name e.g. address. Organize images and files in a network/relational database. Users can design their own information templates and search with multiple keys. Include a powerful editor, file security & Tresearch. Link to clipboard. Pan and zoom within images. Work with PCX, BMP, TIF, GIF, Postscript file Formats. Network Vers. Avail.

Introductory offer - \$185.

Friendly Information Systems, Inc.

34 Bow Avenue, Dedham, MA 02026

(508) 486-0003 or (617) 329-1620

Inquiry 775.

EDUCATION

LEARN COMPUTERS!

BUILD SOLID COMPUTER USER SKILLS

Approved home study. At last—understand the PC! Learn word processing, database, spreadsheets, data communications. Free Literature.

Call Today: 800-223-4542

School of Computer Training, Dept. KB691
2245 Perimeter Park, Atlanta, Georgia 30341

Inquiry 776.

SOFTWARE WANTED

Publish Your Program!

Young, enthusiastic and successful software publishing company looking for PC productivity and utility software to acquire or publish. For a confidential review of your software product, send information to **Software Adv., 2210 Wilshire Blvd., #836, Santa Monica, CA 90403** or circle our number on the Direct Link Card in the back of this issue. We will contact you promptly.

Inquiry 777.

MARKET TO EUROPE!

The BYTE EURODECK

offers you

a unique opportunity

to sell

your computer products

to BYTE's

50,000 European

Subscribers!

Call Jim

for more info!

(603) 924-2533

YOUR DIRECT LINK

ADVERTISER CONTACT INFORMATION

To order products or request FREE information, call advertisers directly or send in the Direct Link Card by mail or fax! Let them know you saw it in **BYTE!**

Inquiry No.	Page No.	Phone No.	Inquiry No.	Page No.	Phone No.	Inquiry No.	Page No.	Phone No.
A			E			N		
158-159	AT & T PARADYNE (N.A.)	191 800-544-4996 ext. 96	430	ECG	76 +31-4937-96808**	* MANCHESTER EQUIP CO	256A-B	516-435-1199
61-62	ABACUS SOFTWARE	183 800-451-4319	* ELONEX (INT'L)	48-49	+44-81-452-6422**	* MANCHESTER EQUIP CO	256NE-1	516-435-1199
367-368	ACI / ACQUIRE	266 +886-2-758-9615**	370	EMPIRE COMPUTECH	270 800-446-1967	97	MARK WILLIAMS CO	111 800-627-5967
166-167	ADVANCED COMPUTER PROD	250 714-558-8813	568	EVOLUTION COMPUTING	256MW-2 800-874-4028	96	MATHSOFT INC	188 800-628-4223
196-197	ADVANCED LOGIC RESEARCH	17 714-581-6770	569	EVOLUTION COMPUTING	256PC-6 800-874-4028	98-99	MAYNARD, AN ARCHIVE CO	138 800-755-0535
64	ADVANCED MICRO DEVICES	14-15 800-222-9323	F			* MCGRAW HILL NRI (N.A.)	240A-B	
164	AER ENERGY	151 800-POWER-20	412	FAST ELECTRONIC GMBH	127 +49-089-533-401**	417	MEGADATA	176IS-3 516-589-6858**
63	ALADDIN KNOWLEDGE SYS	107 800-223-4277	427-428	FIRST INT'L COMPUTER	196IS-3 +88-62-717-4500	366	MEMORY SUPERSTORE	269 800-800-7056
330	AMERICAN ADVANTECH / AAEON	269 800-800-6889	* FIRST SOURCE INT'L	252	714-588-9866	418	MICRO DESIGN INT'L	40IS-4 407-677-8333
563	APPRO INT'L INC	256SO-4 408-732-6091	160-161	FUNK SOFTWARE	193 617-497-6339	100-101	MICRO SOLU COMPUTER PROD	133 815-756-3411
162	ARES MICRO DEVELOPMENT	38-39 800-322-3200	413-414	FUTURESOFT ENGINEERING	40IS-2 713-496-9400	376-377	MICROBIZ	272 800-637-8268
381	AXONIX CORP	268 801-466-9797	G			190	MICROGRAFX	164 800-998-0153
B			* GATEWAY 2000	CII,1	800-523-2000	183-184	MICRO-INTERNATIONAL, INC	254 800-967-5667
192-193	BAY TECHNICAL ASSOC	218 800-523-2702	* GATEWAY 2000	82-83	800-523-2000	175	MICROPROSE SOFTWARE	257 800-879-PLAY
201	BITWISE DESIGNS INC	108 800-367-5906	* GATEWAY 2000	101	800-523-2000	176	MICROPROSE SOFTWARE	259 800-879-PLAY
450	BIX	285 617-491-3342	375	GENERAL TECHNICS	267 800-487-2538	177	MICROPROSE SOFTWARE	260 800-879-PLAY
152-153	BLINK INC	155 804-355-4444	81-82	GENOA SYSTEMS	173 408-432-9090	* MICROSOFT CORP	22-27	800-882-2000
402-403	BORLAND INT'L (INT'L)	CIV	337	GENOVATION, INC	269 800-822-4333	* MICROSOFT CORP	57	800-426-9400
65-66	BORLAND INT'L	13 800-331-0877	83-84	GLENCO ENGINEERING	181 800-562-2543	* MICROSOFT CORP	161	800-426-9400
168	BUFFALO PRODUCTS	263 800-345-2356	338	GMM RESEARCH CORP	266 714-752-9447	* MICROSOFT CORP	163	800-426-9400
401	B&C MICROSYSTEMS	40IS-2 408-730-5511	72-73	GREENVIEW DATA	125 800-458-3348	* MICROSOFT CORP	165	800-426-9400
C			415-416	GREY MATTER LTD	196IS-1 +44-0364-53071**	347	MICROSTAR LABORATORIES	267 206-453-2345
404	CHERRY		339	GTEK INC	266 800-282-4835	564-565	MICROTECH COMPUTER	256SO-3 800-342-6508
	MIKROSCHALTER GMBH	216-217 +49-964-318-262**	H			103	MICROWAY	160 508-746-7341
182	CITITRONICS	256 818-855-5688	371	HARPER COLLINS	266 44-0903-873633**	102	MICROWAY	224 508-746-7341
68-69	COLORADO MEMORY SYS	85 800-346-9881	86-87	HYUNDAI ELECT AMERICA (N.A.)	48-51 800-933-3445	426	MINICOM LTD	96IS-2 +972-2-637576**
70	COMMODORE	175 800-66-AMIGA	I			419	MINOLTA GMBH (INT'L)	105 +49-0511-779089**
405-406	COMPEX INC	77 714-630-7302	88	IBM - CSET/2	55	114	MINUTEMAN	99 214-446-7363
71	COMPUADD EXPRESS	126-127 800-925-3525	191	IBM - DIRECT	63-66 800-IBM-2YOU ext. 213	104	MKS / MORTICE KERN SYS	162 519-884-2251
157	COMPUADYNE	10-11 800-932-COMP	89	IBM - OS/2	86-87	421-422	MOTOROLA UDS	96IS-4 +33-1-4117-4130
407	COMPUSAVE INT'L (INT'L)	CIII 602-437-8208	90	IBM - WORKSTATIONS	114-115 800-IBM-6676	O		
* COMPUSERVE	112A-B	800-848-8199	189	IBM - CREDIT CARDS	156-157 800-IBM-CALL ext. 521	105-106	NANAO USA CORP	105 310-325-5202
202	COMPUSERVE	113 800-848-8199	380	INFINICON	267 800-374-3880	200	NASCOM	238 508-975-4392
75	COMPUTER ASSOCIATES	43 800-CALL-CAI	* INSIGHT			348	NATIONAL INSTRU	272 800-433-3488
76	COMPUTER ASSOCIATES	81 800-CALL-CAI	91	INTEGRAND RESEARCH	98 209-651-1203	* NATIONAL INSTRU	176IDRC1-2	512-794-0100
74	COMPUTER ASSOCIATES	195 800-CALL-CAI	562	INTERMEDIA	256PC-5 203-352-8254	107	NEC - PRINTERS	69 800-388-8888
* COMPUTER PROFESSIONAL'S BOOK SOCIETY	196A-B	717-794-2191	340	IO TECH	270 216-439-4091	206	NETWORK COMP DEVICES (N.A.)	71 800-800-9599
* COMPUTER PROFESSIONAL'S BOOK SOCIETY	197	717-794-2191	341-342	ISLAND SYSTEMS (INT'L)	273 617-273-0421	178	NEVADA COMPUTER	262 800-654-7762
408	COMPUTER QUICK	40IS-2 415-861-8330	431	ITALIAN S/W AGENCY	96IS-3 +39-323-925208**	104	NSTL	261 215-941-9600
331	COMPUTER SYS ARCHITECTS	266 800-753-4CSA	369	IVERSON SOFTWARE, INC	273 416-925-6096	P		
169	COMPUTERLANE UNLTD	247 800-526-3482	J			* PACIFIC DATA PRODUCTS	135	619-625-3568
332	CONTROL VISION	270 316-231-6647	92	JAMECO ELECTRONICS	203 800-831-4242	350	PATTON & PATTON	272 800-525-0082 ext. 112
77	COREL SOFTWARE	46 800-836-SCSI	* JDR MICRODEVICES	265	800-538-5000	115-116	PC POWER & COOLING	91 800-722-6555
442	CPS COMPUTER DISTRIBUTION GMBH	176IS-3 +49-40-656-7969**	429	JEN ELECTRONICA (INT'L)	50 +39-73-3224035**	* PEMCO / UNIFORM SHOW	256PC7-8	800-323-5155
151	CREATIVE LABS INC	33 800-998-LABS	343	JENSEN TOOLS	267 602-968-6231	117-118	PERCEPTIVE SOLUTIONS	202 800-486-3278
78-79	CTX INTERNATIONAL INC	158 714-595-6146	K			119	PERSOFT INC	106 800-368-5283
333	CURTIS INC	266 612-631-9512	93	KEA SYSTEMS LTD	100 800-663-8702	552	PERSONAL SOLU COMP	256MW-3 800-685-3981
441	CYBERDYNE SYSTEMS	176IS-4 +49-241607383**	* KEDWELL SCIENTIFIC	96IS-1	603-433-4777	556	PERSONAL SOLU COMP	256NE-2 800-685-3981
170-171	CYBEX CORP	255 205-534-0010**	551	KENOSHA COMP CTR	256MW-1 800-255-2989	567	PERSONAL SOLU COMP	256SO-2 800-685-3981
372-373	C.P. RESEARCH	268 800-452-7546	555	KENOSHA COMP CTR	256NE-3 800-255-2989	120	PHAR LAP SOFTWARE INC	121 617-661-1510
D			561	KENOSHA COMP CTR	256PC-1 800-255-2989	121-122	PINNACLE MICRO	6-7 714-727-3300
163	DALLAS SEMICONDUCTOR	28 800-258-5061	566	KENOSHA COMP CTR	256SO-1 800-255-2989	123	PIONEER COMMUNICATIONS	95 800-LASER-ON
335	DATALUX CORP (INT'L)	268 +44-306-876718	344	KILA	267 303-444-7737	365	PIXEL PERFECT / MEDICAL ADVISOR	273 800-788-2099
334	DATALUX CORP (INT'L)	270 +44-306-876718	L			124	PKWARE INC	104 414-354-8699
335	DATALUX CORP (N.A.)	268 800-DATALUX	345	LABTECH	273 800-879-5228	554	POLYWELL COMP, INC	256NE-2 800-999-1278
334	DATALUX CORP (N.A.)	270 800-DATALUX	346	LAGUNA DATA SYSTEMS	271 800-859-8856	203	POPKIN S/W & SYSTEMS INC	93 212-571-3434
80	DATAPRO INFO SERVICE GROUP	144 609-764-0100 ext. 2777	94	LAHEY COMPUTER SYS	208 800-548-4778	* POWERCORE	176IDRC1-2	815-468-3737
409-410	DATATRONICS TECH	176IS-4 +886-2-782-0305**	136-137	LANDMARK RESCH INT'L CORP	123 800-683-6696	95	PROGRAMMER'S PARADISE	59-61 800-445-7899
* DELL COMPUTER CORP (N.A.)	CIII	800-626-8260	180	LODE STAR COMPUTER	244-245 800-875-7568	* PROGRAMMER'S SHOP	166-168	800-421-8006
* DELL COMPUTER CORP (N.A.)	CIV	800-626-8260	M			* PROGRAMMER'S SHOP	214-215	800-421-8006
336	DIAGSOFT INC	273 800-DIAGSOFT	154-155	MAG INNOVISION	9 800-827-3998	204-205	PROGRESS SOFTWARE	236 800-4PROGRESS
411	DIGIMETRIE	196IS-4 +33-68-50-27-85**						
172-173	DISTRIBUTED PROC TECH	253 407-830-5522						

YOUR DIRECT LINK CARD

For free product information, mail your completed card today. **For quicker response, fax to 1-413-637-4343!**

See reverse side for card.

1. Circle the Numbers on Your Direct Link Card

Circle the numbers which are found on ads and articles in this issue or circle the product category number and receive information on all advertisers listed in that category.

2. Print Your Name and Address

Answer questions "A" through "E" and mail or fax card to 1-413-637-4343.

3. Product information will be rushed to you from the selected companies!

READER SERVICE
P.O. BOX 5110
Pittsfield, MA 01203-9926
USA

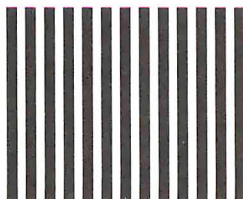
BYTE

POSTAGE WILL BE PAID BY ADDRESSEE

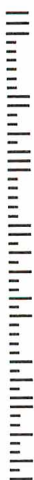
BUSINESS REPLY MAIL
FIRST CLASS MAIL PERMIT NO. 176 PITTSFIELD, MA



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES



BYTE



YOUR DIRECT LINK

ADVERTISER CONTACT INFORMATION

Inquiry No.	Page No.	Phone No.	Inquiry No.	Page No.	Phone No.	Inquiry No.	Page No.	Phone No.						
Q						V								
126	QUA TECH INC	242	800-553-1170	135	SUN MICROSYSTEMS	18-19	800-426-5321 ext. 520	*	VERMONT CREATIVE S/W	21	802-848-3502**			
351	QUALSTAR CORP	272	818-882-5822	156	SUNSOFT	2-3	800-227-9227 ext. 123	438	VIDEO MAKER / VITEC		51+33-146-29-03-04**			
432-433	QUANTUM CORP	190	+41-38-337722	138-139	SYSTAT INC	103	708-864-5670	146-147	VIEWSONIC	79	714-869-7976			
434-435	QUANTUM CORP	191	+41-38-337722	420	SZKI RECOGNITA CORP	40IS-3	+361-201-7607**	423-424	VISIONETICS INT'L	96IS-2	+886-35-772170**			
125	QUARTERDECK OFFICE SYS	143	310-392-9851	T						360	VISTA MICROSYSTEMS	272	508-695-8459	
R									559	VORTEX COMPUTERS	256PC-4	800-548-7839		
127	RAIMA CORP	89	800-327-2462	354	TALKING TECHNOLOGY INC	267	800-685-4884	570	VORTEX COMPUTERS	256MW-4	800-548-7839			
128-129	RAINBOW TECHNOLOGIES	75	800-852-8569	355-356	TECHNOLOGIC SYSTEMS	270	513-644-2230	W						
185-186	RALIN WHOLESALERS	263	800-752-9512	140	TEKTRONIX	37	800-835-6100	425	WALKER, RICHER & QUINN	40IS-1	206-324-0407			
178-179	RECORTEC INC	251	800-729-7654	141	TEXAS INSTRUMENTS	30-31	800-527-3500	148	WATCOM PRODUCTS INC	29	800-265-4555			
130	ROSE ELECTRONICS	8	800-333-9343	*	TEXAS MICROSYSTEMS	144A-B	800-627-8700	374	WENTEK TECHNOLOGY, INC	271	818-960-8808			
S						142	TEXAS MICROSYSTEMS	145	800-627-8700	181	WORLDWIDE TECHNOLOGIES	246	800-457-6937	
352-353	SECURE IT INC	271	800-451-7592	378-379	TOP PC	269	800-333-8144	X						
131	SEQUITER SOFTWARE INC	171	403-437-2410	439-440	TOPEK	126	+886-2-961-9586**	361	XELTEK	271	408-524-1929			
165	SHAPEWARE	35	800-446-3335 ext. EB1	144	TOSHIBA AMERICA INC	44-45	800-457-7777	Z						
357	SIGEN	268	408-737-3904	194-195	TOUCHSTONE SOFTWARE	204	714-969-7746	436-437	ZECKS	196IS-4	+886-2-299-2027**			
132	S'NW ELECTRONICS	102	800-874-1235	187-188	TRANSCEND INFORMATION INC	258	909-598-5500	*	ZENITH DATA SYSTEMS	40A-H	800-523-9393			
*	SOFTLINE CORP	176IS-1	718-438-6057	363	TRANSTOR SYSTEMS LTD	268	800-872-6867	149	ZEOS INTERNATIONAL	136-137	800-423-5891			
198-199	SOFTWARE SECURITY INC	110	203-329-8870	364	TRI VALLEY TECHNOLOGY INC	267	510-447-2030	362	Z-WORLD ENGINEERING	271	916-757-3737			
*	SONY (N.A.)	76-77	800-937-SONY ext. 333	358-359	TRIBAL MICROSYSTEMS	271	510-623-8859	Y						
U									Z					
557-558	ULTRA COMPUTERS	256NE-4	800-755-7518	V										
*	UNIXWORLD	240A-B	800-257-9402											
145	UNIXWORLD	241	800-257-9402											
Z														
149	ZEOS INTERNATIONAL	136-137	800-423-5891											
362	Z-WORLD ENGINEERING	271	916-757-3737											
												<i>* Correspond directly with company.</i>		
												<i>** Indicates FAX Number</i>		

* Correspond directly with company.

** Indicates FAX Number

BYTE ADVERTISING SALES STAFF

Jennifer L. Bartel, National Sales Manager, 14850 Quorum Drive, Suite 380, Dallas, TX 75240, Tel. (214) 701-8496
Liz Coyman, Inside Advertising Sales Director, One Phoenix Mill Lane, Peterborough, NH 03458, Tel. (603) 924-2518

NEW ENGLAND

ME, NH, VT, MA, RI, CT, ONTARIO
CANADA & EASTERN CANADA
(617) 860-6344
Patricia Payne (603) 924-2654
McGraw-Hill Publications
24 Hartwell Avenue
Lexington, MA 02173
FAX: (617) 860-6899

EAST COAST

NY, NY, NJ, DE, PA
Kim Norris (212) 512-2645
Jonathan Sawyer (603) 924-2665
McGraw-Hill Publications
1221 Avenue of Americas—28th Floor
New York, NY 10020
FAX: (212) 512-2075

SOUTHEAST

NC, SC, GA, FL, AL, TN, MS, AR, LA,
KY, DC, MD, VA, WV
MaryAnn Goulding (404) 943-4782
Barry Echavarría (603) 924-2574
McGraw-Hill Publications
4170 Ashford-Dunwoody Rd., Suite 520
Atlanta, GA 30319
FAX: (404) 252-4056

MIDWEST

IL, MO, KS, IA, ND, SD, MN,
WI, NE, IN, MI, OH
Kurt Kelley (312) 616-3328
Ed Ware (603) 924-2664
McGraw-Hill Publications
Two Prudential Plaza
180 North Stetson Ave.
Chicago, IL 60601
FAX: (312) 616-3370

SOUTHWEST

ROCKY MOUNTAIN
CO, OK, TX
Jennifer Walker (214) 701-8496
Larry Levine (603) 924-2637
McGraw-Hill Publications
14850 Quorum Dr., Suite 380
Dallas, TX 75240
FAX: (214) 991-6208

SOUTH PACIFIC: Los Angeles, CA

LOS ANGELES COUNTY, AZ, NM,
Alan El Faye (213) 480-5243
Larry Levine (603) 924-2637
McGraw-Hill Publications
3333 Wilshire Boulevard #407
Los Angeles, CA 90010
FAX: (213) 480-5249

NORTH PACIFIC

NORTHERN CA, OR, ID, MT, WY, UT
Roy J. Kops (415) 513-6861
Joseph Mabe (603) 924-2662
SILICON VALLEY, HI, WA, AK,
W. CANADA
Bill McAfee (415) 513-6862
Jonathan Sawyer (603) 924-2665
SILICON VALLEY, NV
Barbara Holmes (415) 513-6945
Barry Echavarría (603) 924-2574
McGraw-Hill Publications
1900 O'Farrell Street, #200
San Mateo, CA 94403
FAX: (415) 513-6867

SOUTH PACIFIC: Irvine, CA

ORANGE COUNTY
SAN DIEGO COUNTY
Beth Dudas (714) 753-8140
Joseph Mabe (603) 924-2662
McGraw-Hill Publications
15635 Alton Pkwy., Suite 290
Irvine, CA 92718
FAX: (714) 753-8147

Peterborough, NH Office: Inside Sales FAX: 603-924-2683 Advertising FAX: 603-924-7507

Hardware/Software Showcase

Mark Stone (603) 924-2695
Ellen Perham (603) 924-2598
BYTE Publications
One Phoenix Mill Lane
Peterborough, NH 03458

The Buyer's Mart/Classifieds

Margot Gnade (603) 924-2656
BYTE Publications
One Phoenix Mill Lane
Peterborough, NH 03458

BYTE Deck

Brad Dixon (603) 924-2596
BYTE Publications
One Phoenix Mill Lane
Peterborough, NH 03458

EURO-DECK

James Bail (603) 924-2533
BYTE Publications
One Phoenix Mill Lane
Peterborough, NH 03458

Regional & Buyer's Guide

Brian Higgins (603) 924-2651
BYTE Publications
One Phoenix Mill Lane
Peterborough, NH 03458

BYTE International Direct Response Postcards

Ellen Perham (603) 924-2598
BYTE Publications
One Phoenix Mill Lane
Peterborough, NH 03458

INTERNATIONAL ADVERTISING SALES STAFF

GERMANY, SWITZERLAND, AUSTRIA

Jürgen Heise
McGraw-Hill Publishing Co.
Liebigstrasse 19
D-6000 Frankfurt
Germany
Tel: +49 69 71407 140
FAX: +49 69 71407 147

SCANDINAVIAN COUNTRIES

Zena Coupé
A-Z International Sales Ltd.
70 Chalk Farm Road
London NW1 8AN
England
Tel: +44 71 2843171
FAX: +44 71 2843174

UNITED KINGDOM, BENELUX

Gary Lucas (+44 81 545 6268)
McGraw-Hill Publishing Co.
Wimbledon Bridge House
One Hatfield Road
Wimbledon, London SW19 3RU
England
FAX: +44 81 5456294
TELEX: 892191

FRANCE, ITALY

Zena Coupé, Amanda Blaskett
A-Z International Sales Ltd.
70 Chalk Farm Road
London NW1 8AN
England
Tel: +44 71 2843171
FAX: +44 71 2843174

ISRAEL

Dan Ehrlich
Ehrlich Communication Int'l.
P.O. Box 99
Herzliya 46101, Israel
Tel: +972 52 586245
Tel: +972 52 586246
FAX: +972 52 585885

AUSTRALIA

Rod Tremain
Rod Tremain Media
45 Pymble Ave.
Pymble 2073, Sydney
Australia
Tel: +61 2 9983339
FAX: +61 2 9983424

JAPAN

Masaki Mori
Transworld Media Inc.
4th Floor, 1-26-6 Kamimeguro
Meguro-ku, Tokyo 153, Japan
Tel: +81 3 57210761
FAX: +81 3 57210762

KOREA

Young-Seoh Chinn
JES MEDIA INT'L
5th Floor, Banpo Bldg.
40-7, Chamwon-Dong, Seocho-Gu
Seoul 137-030, Korea
Tel: +82 2 5458001
Tel: +82 2 5458002
FAX: +82 2 5498861

SINGAPORE

Derek Ng
Stephen Tay
Third Wave Publishing Corp.
1123 Serangoon Road, #03-01
Singapore 1232
Tel: +65 296 6166
FAX: +65 298 7551

HONG KONG

Candice Lo
Third Wave Publishing Corp.
Unit 2, 6F Hing Wah Center
82-84 To Kwa Wan Road
Kowloon, Hong Kong
Tel: +852 764 3830
FAX: +852 764 3857

MALAYSIA

Servex (Malaysia) Sdn. Bhd.
H.K. Lin
5th Floor, Bena Tower
160, Jalan Ampang
50450 Kuala Lumpur, Malaysia
Tel: +60 3 2624592
FAX: +60 3 2624591

THAILAND

Jack Hu
Sahaviriya OA Group
28/1 Prapawit Bldg., Surasak Rd.
Silom, Bangkok 10500
Thailand
Tel: +66 2 2360295
FAX: +66 2 2365960

TAIWAN

Liwen Lee
Third Wave Publishing Corp.
2nd Fl., No. 19-1, Lane 231
Fu Hsing North Road
Taipei 10445, Taiwan
R.O.C.
Tel: +886 2 7136959
FAX: +886 2 7151950

INDIA, INDONESIA, PAKISTAN, PHILIPPINES, OTHER ASIAN AND PACIFIC COUNTRIES

K.T. Wu
Third Wave Publishing Corp.
2nd Fl., No. 19-1, Lane 231
Fu Hsing North Road
Taipei 10445, Taiwan
R.O.C.
Tel: +886 2 7136959
FAX: +886 2 7151950

YOUR DIRECT LINK

PRODUCT CATEGORY INDEX

For **FREE** product information from individual advertisers, circle the corresponding inquiry numbers on Your Direct Link Card!

To receive information for an entire product category, circle the category number on Your Direct Link Card!

Category No. Inquiry No.	Page No.	Category No. Inquiry No.	Page No.	Category No. Inquiry No.	Page No.
HARDWARE					
1 ACCESSORIES/SUPPLIES				14 MAIL ORDER	
164 AER ENERGY	151	552 PERSONAL SOLUTION COMPUTERS	256MW-3	166-167 ADVANCED COMPUTER PRODUCTS	250
436-437 ZECKS	196IS-4	556 PERSONAL SOLUTION COMPUTERS	256NE-2	330 AMERICAN ADVANTECH / AAEON	269
		567 PERSONAL SOLUTION COMPUTERS	256SO-2	162 ARES MICRO DEVELOPMENT	38-39
		178-179 RECORTEC INC	251	182 CITITRONICS	256
		135 SUN MICROSYSTEMS	18-19	71 COMPUADD EXPRESS	126-127
		* TEXAS MICROSYSTEMS	144A-B	157 COMPUADYNE	10-11
		142 TEXAS MICROSYSTEMS	145	169 COMPUTERLANE UNLIMITED	247
		364 TRI VALLEY TECHNOLOGY INC	267	92 JAMECO ELECTRONICS	203
2 ADD-IN BOARDS		557-558 ULTA COMPUTERS	256NE-4	* JDR MICRODEVICES	265
367-368 ACI / ACQUIRE	266	* ZENITH DATA SYSTEMS	40A-H	551 KENOSHA COMPUTER CENTER	256MW-1
* CHERRY MIKROSCHALTER GMBH	216	149 ZEOS INTERNATIONAL	136-137	555 KENOSHA COMPUTER CENTER	256NE-3
404 CHERRY MIKROSCHALTER GMBH	217			561 KENOSHA COMPUTER CENTER	256PC-1
405-406 COMPEX INC	77			566 KENOSHA COMPUTER CENTER	256SO-1
331 COMPUTER SYSTEM ARCHITECTS	266			180 LODE STAR COMPUTER	244-245
333 CURTIS INC	266	6 DATA ACQUISITION		174 NEVADA COMPUTER	262
411 DIGIMETRIE	196IS-4	347 MICROSTAR LABORATORIES	267	552 PERSONAL SOLUTION COMPUTERS	256MW-3
172-173 DISTRIBUTED PROCESSING TECH	253	* NATIONAL INSTRUMENTS	176IDRC1-2	556 PERSONAL SOLUTION COMPUTERS	256NE-2
81-82 GENOA SYSTEM	173	126 QUA TECH INC	242	567 PERSONAL SOLUTION COMPUTERS	256SO-2
189 IBM - CREDIT CARD	156-157			185-186 RALIN WHOLESALERS	263
92 JAMECO ELECTRONICS	203			132 S'NW ELECTRONICS	102
429 JEN ELECTRONICA (INT'L)	50	7 DISK & OPTICAL DRIVES		557-558 ULTA COMPUTERS	256NE-4
111-112 ORCHID TECHNOLOGY	211	375 GENERAL TECHNICS	267		
117-118 PERCEPTIVE SOLUTIONS	202	98-99 MAYNARD, AN ARCHIVE CO	138	15 MEMORY/CHIPS/UPGRADES	
126 QUA TECH INC	242	418 MICRO DESIGN INTERNATIONAL	40IS-4	64 ADVANCED MICRO DEVICES	14-15
354 TALKING TECHNOLOGY INC	267	100-101 MICRO SOLUTIONS COMP PROD	133	182 CITITRONICS	256
439-440 TOPTEK	126	121-122 PINNACLE MICRO	6-7	* FIRST SOURCE INT'L	252
423-424 VISIONETICS INTERNATIONAL	96IS-2	123 PIONEER COMMUNICATION	95	92 JAMECO ELECTRONICS	203
		432-433 QUANTUM CORP	190	366 MEMORY SUPERSTORE	269
		434-435 QUANTUM CORP	191	187-188 TRANSCEND INFORMATION INC	258
		357 SIGEN	268	181 WORLDWIDE TECHNOLOGIES	246
		* SONY (N.A.)	76-77		
4 COMMUNICATIONS/NETWORKING		363 TRANTOR SYSTEMS LTD	268	16 MISCELLANEOUS HARDWARE	
192-193 BAY TECHNICAL ASSOC	218			401 B&C MICROSYSTEMS	40IS-2
* ELONEX (INT'L)	48-49	9 FAX BOARDS/MACHINES		430 ECG	76
338 GMM RESEARCH CORP	266	421-422 MOTOROLA UDS	96IS-4	91 INTEGRAND RESEARCH	98
339 GTEK INC	266				
380 INFINICON	267	10 GRAPHICS TABLETS/MICE/PEN INPUT		17 MODEMS/MULTIPLEXORS	
343 JENSEN TOOLS	267	372-373 C.P. RESEARCH	268	158-159 A T & T PARADYNE (N.A.)	191
417 MEGADATA	176IS-3	* MICROSOFT CORP	57	409-410 DATATRONICS TECHNOLOGY	176IS-4
564-565 MICROTCH COMPUTER	256SO-3			421-422 MOTOROLA UDS	96IS-4
426 MINICOM LTD	96IS-2			185-186 RALIN WHOLESALERS	263
421-422 MOTOROLA UDS	96IS-4	11 KEYBOARDS			
130 ROSE ELECTRONICS	8	404 CHERRY MIKROSCHALTER GMBH	216-217	18 MONITORS & TERMINALS	
354 TALKING TECHNOLOGY INC	267	335 DATALUX CORP	268	78-79 CTX INTERNATIONAL INC	158
355-356 TECHNOLOGIC SYSTEMS	270			334 DATALUX CORP	270
		12 LAN HARDWARE		* ELONEX (INT'L)	48-49
5 COMPUTER SYSTEMS		192-193 BAY TECHNICAL ASSOC	218	154-155 MAG INNOVISION	9
563 APPRO INTERNATIONAL INC	256SO-4	170-171 CYBEX CORP	255	105-106 NANA USA CORP	105
162 ARES MICRO DEVELOPMENT	38-39	98-99 MAYNARD, AN ARCHIVE CO	138	109-110 OPTIQUEST	129
404 CHERRY MIKROSCHALTER GMBH	216-217	426 MINICOM LTD	96IS-2	146-147 VIEWSONIC	791
70 COMMODORE	175	115-116 PC POWER & COOLING	91		
71 COMPUADD EXPRESS	126-127			19 MULTIMEDIA	
157 COMPUADYNE	10-11	13 LAPTOPS & NOTEBOOKS		332 CONTROL VISION	270
441 CYBERDYNE SYSTEMS	176IS-4	196-197 ADVANCED LOGIC RESEARCH	17	442 CPS COMPUTER DISTRIBUTION GMBH	176IS-3
* DELL COMPUTER CORP (N.A.)	CIII	164 AER ENERGY	151	151 CREATIVE LABS INC	33
* DELL COMPUTER CORP (N.A.)	CIV	381 AXONIX CORP	268	78-79 CTX INTERNATIONAL INC	158
430 ECG	76	201 BITWISE DESIGNS INC	108	370 EMPIRE COMPUTECH	270
* ELONEX (INT'L)	48-49	441 CYBERDYNE SYSTEMS	176IS-4	94 LAHEY COMPUTER SYSTEMS	208
* GATEWAY 2000	CII,1	427-428 FIRST INTERNATIONAL COMPUTER	196IS-3	* MICROSOFT CORP	161
* GATEWAY 2000	82-83	337 GENOVATION, INC	269	* MICROSOFT CORP	163
* GATEWAY 2000	101	183-184 MICRO-INTERNATIONAL, INC	254	* MICROSOFT CORP	165
371 HARPER COLLINS	266	554 POLYWELL COMPUTERS, INC	256NE-2	* SONY (N.A.)	76-77
86-87 HYUNDAI ELECTRONICS AMERICA (N.A.)	48-51	141 TEXAS INSTRUMENTS	30-31	140 TEKTRONIX	37
191 IBM - DIRECT	63-66	378-379 TOP PC	269	439-440 TOPTEK	126
90 IBM - WORKSTATIONS	114-115	144 TOSHIBA AMERICA INC	44-45	438 VIDEO MAKER / VITEC	51
* INSIGHT DISTRIBUTION NETWORK	248-249	559 VORTEX COMPUTERS	256PC-4		
344 KILA	267	570 VORTEX COMPUTERS	256MW-4		
* MANCHESTER EQUIPMENT CO	256A-B	* ZENITH DATA SYSTEMS	40A-H		
553 MANCHESTER EQUIPMENT CO	256NE-1	149 ZEOS INTERNATIONAL	136-137		
183-184 MICRO-INTERNATIONAL, INC	254				
564-565 MICROTCH COMPUTER	256SO-3				
108 NSTL	261				
560 O-C-T SYSTEMS	256PC2-3				
115-116 PC POWER & COOLING	91				

YOUR DIRECT LINK

PRODUCT CATEGORY INDEX

For **FREE** product information from individual advertisers, circle the corresponding inquiry numbers on your Direct Link Card!

To receive information for an entire product category, circle the category number on your Direct Link Card!

Category No. Inquiry No.	Page No.	Category No. Inquiry No.	Page No.	Category No. Inquiry No.	Page No.
20 PRINTERS/PLOTTERS		30 EDUCATIONAL		41 SECURITY	
192-193 BAY TECHNICAL ASSOC	218	431 ITALIAN SOFTWARE AGENCY	96IS-3	203 POPKIN S/W & SYSTEMS INC	93
168 BUFFALO PRODUCTS	263	127 RAIMA CORP	89	204-205 PROGRESS SOFTWARE	236
419 MINOLTA GMBH (INT'L)	105	131 SEQUITER SOFTWARE INC	171	148 WATCOM PRODUCTS INC	29
107 NEC - PRINTERS	69				
* PACIFIC DATA PRODUCTS	135	31 ENGINEERING/SCIENTIFIC			
355-356 TECHNOLOGIC SYSTEMS	270	61-62 ABACUS SOFTWARE	183	63 ALADDIN KNOWLEDGE SYSTEMS	107
140 TEKTRONIX	37			163 DALLAS SEMICONDUCTOR	28
				412 FAST ELECTRONIC GMBH	127
21 PROGRAMMABLE HARDWARE				83-84 GLENCO ENGINEERING	181
401 B&C MICROSYSTEMS	40IS-2	136-13 LANDMARK RESEARCH INT'L CORP	123	128-129 RAINBOW TECHNOLOGIES	75
340 IO TECH	270	97 MATHSOFT INC	188	198-199 SOFTWARE SECURITY INC	110
358-359 TRIBAL MICROSYSTEMS	271	96 MATHSOFT INC	229		
361 XELTEK	271	360 VISTA MICROSYSTEMS	272		
362 Z-WORLD ENGINEERING	271			43 SOFTWARE DUPLICATION	
				412 FAST ELECTRONIC GMBH	127
22 SCANNERS/OCR/DIGITIZERS					
564-565 MICROTECH COMPUTER	256SO-3	32 ENTERTAINMENT		45 UNIX	
		442 CPS COMPUTER DISTRIBUTION GMBH	176IS-3	72-73 GREENVIEW DATA	125
52 SECURITY		175 MICROPROSE SOFTWARE	257	* MARK WILLIAMS CO	111
352-353 SECURE IT INC	271	176 MICROPROSE SOFTWARE	259	104 MKS / MORTICE KERN SYSTEMS	162
374 WENTEK TECHNOLOGY, INC	271	177 MICROPROSE SOFTWARE	260	206 NETWORK COMPUTING DEVICES (N.A.)	71
				156 SUNSOFT	2-3
23 TAPE DRIVES		33 GRAPHICS			
68-69 COLORADO MEMORY SYSTEMS	85	77 COREL SOFTWARE	46	46 UTILITIES	
346 LAGUNA DATA SYSTEMS	271	78-79 CTX INTERNATIONAL INC	158	63 ALADDIN KNOWLEDGE SYSTEMS	107
98-99 MAYNARD, AN ARCHIVE CO	138	190 MICROGRAFX	164	336 DIAGSOFT INC	273
349 OVERLAND DATA INC	272	105-106 NANA USA CORP	105	136-137 LANDMARK RESEARCH INT'L CORP	123
351 QUALSTAR CORP	272	350 PATTON & PATTON	272	124 PKWARE INC	104
		165 SHAPEWARE	35	* POWERCORE	176IDRC1-2
		140 TEKTRONIX	37	194-195 TOUCHSTONE SOFTWARE	204
				* VERMONT CREATIVE SOFTWARE	21
24 UPS		35 MAIL ORDER			
114 MINUTEMAN	99	63 ALADDIN KNOWLEDGE SYSTEMS	107	47 WINDOWS	
115-116 PC POWER & COOLING	91	407 COMPUSAVE INTERNATIONAL (INT'L)	CIII	61-62 ABACUS SOFTWARE	183
		408 COMPUTER QUICK	40IS-2	442 CPS COMPUTER	
		415-416 GREY MATTER LTD	196IS-1	DISTRIBUTION GMBH	176IS-3
		95 PROGRAMMER'S PARADISE	59-61	415-416 GREY MATTER LTD	196IS-1
		* PROGRAMMER'S SHOP	166-168	341-342 ISLAND SYSTEMS (INT'L)	273
		* PROGRAMMER'S SHOP	214-215	93 KEA SYSTEMS LTD	100
		* SOFTLINE CORP	176IS-1	345 LABTECH	273
				* MICROSOFT CORP	22-27
				105-106 NANA USA CORP	105
				119 PERSOFT INC	106
				365 PIXEL PERFECT / MEDICAL ADVISOR	273
SOFTWARE		36 MATHEMATICAL/STATISTICAL		GENERAL	
25 BUSINESS		134 STATSOFT	109	49 BOOKS/PUBLICATIONS	
75 COMPUTER ASSOCIATES	43	138-139 SYSTAT INC	103	61-62 ABACUS SOFTWARE	183
160-161 FUNK SOFTWARE	193			450 BIX	285
371 HARPER COLLINS	266			* COMPUTER	
376-377 MICROBIZ	272	38 ON-LINE SERVICES		* PROFESSIONAL'S BOOK SOCIETY	196A-B
420 SZKI RECOGNITA CORP	40IS-3	* COMPUSERVE	112A-B	* COMPUTER	
		202 COMPUSERVE	113	* PROFESSIONAL'S BOOK SOCIETY	197
				80 DATAPRO INFORMATION SERVICES GROUP	144
26 CAD/CAM		39 OPERATING SYSTEMS		371 HARPER COLLINS	266
568 EVOLUTION COMPUTING	256MW-2	89 IBM - OS/2	86-87	* MCGRAW HILL NRI (N.A.)	240A-B
569 EVOLUTION COMPUTING	256PC-6	* MARK WILLIAMS CO	111	113 OSBORNE MCGRAW-HILL	264
		206 NETWORK COMPUTING DEVICES (N.A.)	71	* UNIXWORLD	240A-B
		125 QUARTERDECK OFFICE SYSTEMS	143	145 UNIXWORLD	241
27 COMMUNICATIONS/NETWORKING		40 PROGRAMMING LANGUAGES/TOOLS		51 MISCELLANEOUS	
160-161 FUNK SOFTWARE	193	152-153 BLINK INC	155	* BYTE SUB MESSAGE	102
413-414 FUTURESOFTE ENGINEERING	40IS-2	402-403 BORLAND INTERNATIONAL (INT'L)	CIV	562 INTERMEDIA	256PC-5
426 MINICOM LTD	96IS-2	74 COMPUTER ASSOCIATES	195	* PEMCO / UNIFORM SHOW	256PC7-8
200 NASCOM	238	412 FAST ELECTRONIC GMBH	127		
119 PERSOFT INC	106	72-73 GREENVIEW DATA	125		
425 WALKER, RICHER & QUINN	40IS-1	415-416 GREY MATTER LTD	196IS-1		
		88 IBM - CSET/2	55		
28 DATA ACQUISITION		369 IVERSON SOFTWARE, INC	273		
348 NATIONAL INSTRUMENTS	272	* KEDWELL SCIENTIFIC	96IS-1		
* NATIONAL INSTRUMENTS	176IDRC1-2	103 MICROWAY	160		
		102 MICROWAY	224		
29 DATABASE		104 MKS / MORTICE KERN SYSTEMS	162		
65-66 BORLAND INTERNATIONAL	13	120 PHAR LAP SOFTWARE INC	121		
76 COMPUTER ASSOCIATES	81				

EDITORIAL INDEX

For more information on any of the companies covered in articles, columns, or news stories in this issue, circle the appropriate inquiry number on Your Direct Link Card. Each page number refers to the first page of the article or section in which the company name appears.

Inquiry No.	Page No.	Inquiry No.	Page No.	Inquiry No.	Page No.	Inquiry No.	Page No.
A		E		N		S	
1228	Adobe Systems 62, 116, 211	1141	Digispeech 73	1158	Mainstream Data 177	1310	Saltire Software 96
	Advanced Logic Research 222		Digital Research 58	1300	MAI Systems 90	997	Samsung Software America 178
1272	Aitech International 78	1309	Digital Soup 94		Mammoth Micro Productions 116	1306	The San Francisco Canyon Company
987	Alcom 178		Donnelly Marketing 116		Maxoptix 116		Shapeware 41
983	Aldus Consumer Division 97	1063	Dove Computer 198		McCaw Cellular 146		Siemens 47
	AMD 32	1282	DSK 80	1283	McGraw-Hill 139		Sierra Online 139
1146	Apple Computer 32, 41, 58, 139, 146, 169, 177, 211, 221, 222, 225, 239	E		1279	M-Group 80		Silicon Graphics 32, 225, 239
1060	Applied Engineering 198	1229	Eclipse Systems 213	1159	MicroApps 80		SilverPlatter 116
1147	Ardis 146, 177		Electronic Book Technologies 116		Microcom 146, 177	1165	SkyTel 146, 177
	Arlen Communications 139		Enterprise Corp. of America 116	984,	Micro Focus 32	1296	Slate 88
979	Artisoft 97	1151	EO 41, 169, 177	1169,	Micrografx 237		SMC 222
	Ashton-Tate 32	1152	Ericsson GE Mobile 146, 177	1226	Microsoft 32, 41, 47, 54, 56, 62, 97, 209, 222, 237, 286	1077	Sony 116
	AST Research 47		Communications 116	1277	MicroSpeed 80	996	STF Technologies 178
	Asymetrix 56	1133	EuroPak International 72		Mobile Telecommunication Technologies 146	1287	SunConnect 84
	AT&T 47, 58, 146, 169	1153	Ex Machina 146, 177		Mobile Telesystems 146		Sun Microsystems 32, 41, 116, 178, 286
1148	AT&T Microelectronics 177	1064	Extreme Systems 198	1069	Mobius Technologies 198		SunSelect 32
1170	Atari 58	F		1280	Moonlight Computer Products 80		SunSoft 32
1281	The Audio File 80		Forrester Research 146	1160,	Motorola 58, 146, 177, 239	1168	SuperMac Technology 56
	Avalanche Development 116		Freeman Associates 116	1161	Mtel 146	1233	Supra 213
	Avid Technology 225	1224	Frontier Technologies 217	N		981	Symantec 97
	Avis 146	1065	Fusion Data Systems 198	1173	National Semiconductor 41, 62	1311	Synoptics Communications 222
B			Future Domain 32		National Technical Information Service 116	1070	System Technology 198
	Banyan Systems 222	G			NEC Technologies 116	T	
1303	Beacon Expert Systems 90	1234	Gamma Productions 221	1225	NetManage 217		Tadpole Technology 32
1223	Beame & Whiteside 217	1276	Genoa Systems 78	1273	NewGen Systems 78		Tandem Computers 139
	Bell Atlantic Mobile Systems 146	1154	Go Corp 169, 177		Next 58, 239		Tandon 47
	Bell South Mobile Systems 146	1155	Granite Communications 177	1136	North-East Microcomputer 72		Tandy 32, 116, 139
	Borland International 32, 178, 235	H			Novell 32, 178, 222	1142	Tektronix 74
	Boss Logic 239		Hantarex 47	O			Television Computer 139
1061	Brainstorm Products 198	1066	Harris Laboratories 198	993	OAZ Communications 178		Tetherless Access 159
988	The Bristol Group 178	1156	Hewlett-Packard 32, 41, 62, 116, 139, 169, 177		OCR Servant 239		Texas Instruments 41, 58
1144	Brother International 74	1138	Hitachi America 73, 116		Olidata 47		Thomas-Conrad 222
	Brown-Wagh 41		HSD Microcomputer 239		Olivetti 47	1071	Total Systems 198
	Bureau of Electronic Publishing 116		Hub Data 116	1286	OmniTel 84	1131	Tri-Star Computer 72
C		I		978	Ontrack Computer Systems 97		TV Answer 139
	CableLabs 139	1289	Ibex Technologies 84		OptImage 116	U	
	Cabletron Systems 222		IBM 32, 41, 47, 58, 116, 146, 159, 217, 222, 237, 286	994	Optus Software 178	1307	UCM 94
1230	Caere 213	1132	Identity Systems Technology 72		Otis Elevator 146		UltiMotion 32
989	Calculus 178	1139	Image Systems 73	P		1285	UltraStor 84
	Canon 62	1067	Impulse Technologies 198		Pacific Communications Sciences 146	1278	Unlimited Systems 80
1135	Canon Computer Systems 72	1157	Individual 146, 177	1305	Passport Designs 94	1312	Useful Software 96
	Cayman Systems 239		InfoTech 116	982	PennComp Software Development 97		U.S. Geological Survey 116
1149	CDI 177	992,	Intel 178, 213		Philips 32, 116	V	
	Cellular Data 146	1232		1299	Phoenix Phive Software 90	1294	V.I. 88
1297	CenterLine Software 88	1274	Intelligent Automation 78		Pinnacle Micro 116		Videoway 139
990	Cheyenne Software 178		Interactive Network 139		Pioneer Communications of America 116	1140	ViewSonic 73
991	Circuit Research 178	1298	Italian Software Agency 88		Powercore 90	1295	Visible Systems 88
976	Codewright's Toolworks 97	J		1301	Prisma Office 90		Voice Networking Systems 139
1271	Codonics 74	1076	JVC Information Products 116	1302	Prometheus Products 213	1308	Voyetra Technologies 94
	Commodore Business Machines 32	K		1222	Pure Data 178	W	
1275	Communication Automation & Control 78		Kodak 41, 116, 239	995			Watcom 32
	Compaq Computer 47, 62, 178		Kyocera 41	Q		1134	Wen Technology 72
1221	The Complete PC 213	L		1171	QMS 62	977	WexTech Systems 97
	Corel Systems 32	1288	Lancast 84	1162	Qualcomm 146, 159, 177	1313	Woodside Technologies 96
1143	CTSI International 74	980	LaserMaster 97	R		1174	WordPerfect 32, 41, 47, 62
1150	Cue Network 146, 177	1137	Laura Technologies 73	1163	Radiomail 177	X	
	Cyrix 32		The Library 116	1164	RAM Mobile Data 146, 159, 177	XPress Information Services 139	
D		1167,	Lotus Development 32, 47, 52, 62	1145	Reflex 74	Y	
	Datapro 139	1172			Rosenthal Engineering 32	1078	Young Minds 116
1075	Dataware Technologies 116	M					
1062	DayStar Digital 198		Macess 116				
	DEC 32, 41	1068	MacProducts USA 198				
	Delrina Technology 213		Macronix 41				
	Digipress 116						
				Z			
							Zenith Electronics 47, 139
						1231	ZSoft 213
						1166	Zykel USA 146, 177

Where Do You Go for Help When You're the Expert?

BIX is the collective computing power of thousands of hardware and software engineers, independent consultants, systems designers, technology buffs, and computer industry celebrities. With BIX and the people you'll meet online, you'll have access to information, software, source code, news reports, and advice. And BIX now offers an optional access program that lets you take advantage of WindowsTM while you're online.*

BIX is a Great Deal!

Subscribe to BIX for only \$13 per month! You can access BIX via SprintNet or Tymnet from over 600 locations in the continental US. Connect for only \$3 per hour in the evening and on weekends. Daytime rates are \$9 per hour. **International users:** access from many international locations at 9600 bps for \$24 per hour using SprintNet.

Join BIX Now!

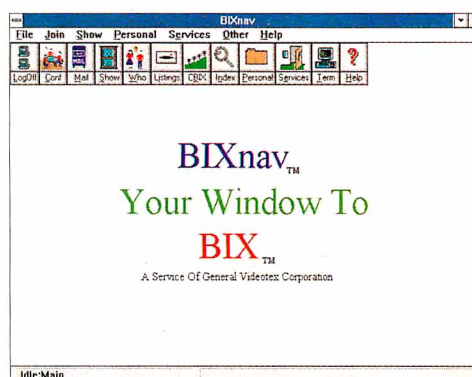
Using any communications program:

- Dial by modem: 1-800-695-4882
- At "login" enter **bix**
- At "Name?" enter **bix.byte**

Further details and rate information will be provided during the toll-free registration.

BIX

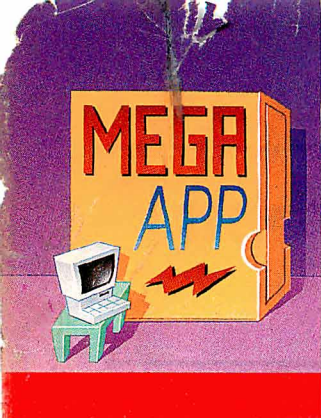
- Access at **9600 bps** with **NO SURCHARGE**
- Search the full text of **BYTE** online
- Get quick answers to tough coding questions from industry experts
- Download source code, utilities, & other programs from **BYTE**
- Chat with other BIX members in real time
- Access via telnet over the Internet - telnet x25.bix.com, then type bix



*Optional WindowsTM access program — just \$9.95

Money-Back Guarantee: If for any reason you aren't happy with BIX, simply cancel your account and request a refund of your first monthly fee.

Questions? Call 1-800-695-4775; fax: 617-491-6642; or send Internet mail to: bix@genvid.com



STOP BIT

ANDY
NICHOLSON

SOFTWARE GLUTTONY

A new world of bloated software threatens to consume all computing resources in its path

Software developers in the personal computer industry have lost their way. They're writing software that's inefficient on today's computers, all the while assuming that tomorrow's computers will be powerful enough to carry the extra burden. This is a serious error. In their rush to provide every imaginable feature in their programs, developers have lost sight of what their customers really want.

Not everyone wants to upgrade to tomorrow's hardware, and users are increasingly moving toward notebook computers, which are a step behind today's desktop machines in terms of available resources. These notebook computers must struggle to run today's

crop of bloated desktop applications. Given current trends in software development, they will be unable to run the even-bigger software of tomorrow.

If users considered notebook computers ineffective because they lack the capacity to run big software, they might be less likely to buy one. But the truth is that users are more willing to buy a notebook computer than to upgrade an existing desktop computer. Thus, a huge new market is caught in a software catch-22, where buyers wait for notebook computers that are powerful enough to run their new software while software developers bog down hardware with ever-larger applications. Programmers must analyze their audience and the limitations of their preferred hardware. They must create software that is efficient on today's computers or risk losing out to those who do.

Some programmers consider this approach to be an unnecessary limitation on their creative abilities. They are being held back, they say. Their imagination cannot run free in a world of limited memory and CPU power, they say. They're being unrealistic. Gluttony is the mark of a bad programmer.

Good programmers should always follow the principles of elegance, simplicity, economy, and effectiveness in their work. The aesthetics of quality programming require economical use of resources. No matter how fast the CPU, a wasted cycle is a wasted cycle. Programmers must avoid waste by squeezing all the fat from their programs.

Big resource-hogging programs are easy to find. The X Window System once ran fine on a 4-MB Sun-3/50 workstation, but the latest version doesn't perk up until

you upgrade to an 8-MB Sparcstation. And you better have 16 MB if you want to run programs using bloated X toolkits like OpenWindows or Motif. The PC world is not immune to such overindulgence. Word processors like Microsoft Word and WordPerfect come stuffed with every imaginable option and gorge themselves on as much as 15 MB of disk space and 4 MB of memory.

The fantastically successful Lotus 1-2-3 offers programmers an instructive example. The original IBM PC version of VisiCalc did not take advantage of the IBM PC's increased capabilities. Microsoft grabbed the opportunity to produce a powerful, full-featured spreadsheet with Multiplan, winning numerous accolades and awards. Lotus 1-2-3 came to market later and without as much fanfare, but it was smaller and faster, and it eclipsed Multiplan almost immediately. Lotus 1-2-3 offered more spreadsheet power by taking the best advantage of the IBM PC.

The moral is to design software that works well today and allows for improvements tomorrow. Then implement the code to work well on today's hardware. The ingenuity, originality, and foresight of your design will become increasingly apparent as it outperforms competitors on forthcoming generations of faster hardware.

Start your work on the smallest, lightest notebook computer you can find, and use all your cleverness, ingenuity, and creativity to write software that makes the best possible use of the resources in the machine. The hardware limits you now, but people can use it today, and you will have a solid foundation for growth.

Now watch as your existing customers tell their friends. The friends who buy the latest hardware with your software will want more. Let your mind wander. What new features can you add to make the best possible use of the new hardware? What clever techniques can you use? What can you do to put yourself another generation ahead of your competitors? Program for your audience, not your ego, and your customers will love you. ■

Andy Nicholson is a senior programmer/analyst working in network software development at Cray Research (Eagan, MN). You can reach him on BIX c/o "editors" or on the Internet at droid@cray.com.

Stop Bit is a forum for informed opinion on personal computing topics. The opinions expressed are those of the author and not necessarily those of BYTE. Your contributions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

NOW THAT WE'RE SO FAR AHEAD OF THE COMPETITION, WE CAN AFFORD TO RELAX A BIT.

CUSTOMER SATISFACTION SURVEY									
Source: Reliability Ratings™ - 1992 PC Vendor Survey*									
SERVICE	TECHNICAL SUPPORT	PRICE	RELIABILITY	UPGRADEABILITY	FUNCTIONALITY	MONITOR	OVERALL SATISFACTION		
1. DELL (8.63)	1. DELL (8.09)	1. DELL (8.62)	1. DELL (8.96)	1. DELL (8.52)	1. DELL (8.73)	1. DELL (8.31)	1. DELL	(8.77)	
2. APPLE (8.06)	2. IBM (7.99)	2. COMPAQ (8.62)	2. COMPAQ (8.95)	2. APPLE (7.64)	2. COMPAQ (8.45)	2. APPLE (8.08)	2. COMPAQ	(8.45)	
3. IBM (8.01)	3. APPLE (7.72)	3. APPLE (8.58)	3. APPLE (8.58)	3. COMPAQ (7.48)	3. APPLE (8.40)	3. COMPAQ (7.60)	3. APPLE	(8.14)	
4. COMPAQ (8.00)	4. COMPAQ (7.71)	4. IBM (8.01)	4. IBM (8.54)	4. IBM (8.91)	4. IBM (7.96)	4. IBM (7.38)	4. IBM	(7.89)	

Survey was independently conducted by Reliability Ratings, Inc., a subscriber-based research firm that does business with most of the FORTUNE 500®.

DELL™

800-388-3355

WHEN CALLING, PLEASE REFERENCE #11E91.

HOURS: 7AM-9PM CT MON-FRI, 8AM-4PM CT SAT, 10AM-3PM CT SUN.

IN CANADA, CALL 800-668-3021. IN MEXICO CITY, 228-7811.

**THE NEW DELL 425s/L
i486 SX 25 MHz SYSTEM
\$1,749**

- LEASE: \$65/MO.
- 4 MB RAM
- 120 MB (17 ms) HARD DRIVE
- 3 ISA EXPANSION SLOTS
- UPGRADEABLE PROCESSOR
- ACCELERATED LOCAL BUS VIDEO WITH 1 MB VIDEO RAM (UP TO 15 MILLION WINMARKS)
- SVGA 1024I MONITOR (14", 1024 X 768, .28mm)



Up to 65% quicker maintenance.

It's easy to get into this computer. Just loosen a couple of thumbscrews for easy access to the modular chassis.



Up to 2.6 times the video performance.

With our new accelerated local bus video revving up your screen, who needs a VCR?

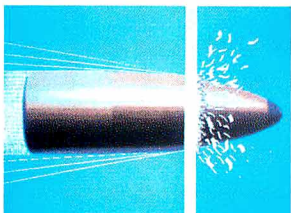


Guaranteed compatibility.

We get along with anyone. Our computers are network-compatible with Novell, Banyan, and UNIX® systems. And we're the only company with a written compatibility guarantee.

**THE NEW DELL 433/M
i486 DX 33 MHz SYSTEM
\$2,499**

- LEASE: \$92/MO.
- 4 MB RAM
- 170 MB (17 ms) HARD DRIVE
- 128 KB EXTERNAL CACHE
- 6 ISA EXPANSION SLOTS
- UPGRADEABLE PROCESSOR
- ACCELERATED LOCAL BUS VIDEO WITH 1 MB VIDEO RAM (UP TO 20 MILLION WINMARKS)
- SVGA 1024I MONITOR (14", 1024 X 768, .28mm)



Up to 178% faster video.

Faster PageMaker redraws and lightning-quick Windows repaints. Speed freaks, rejoice.



Greater upgradeability.

You can upgrade all the way to the top 486, the 66 MHz DX2. You'll even be able to add the Pentium technology from Intel.

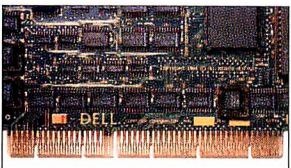


Up to 29% more system performance.

With our new optimized cache as an option, you can give your system a boost whenever you want.

**THE NEW DELL 450/ME
i486 DX2 50 MHz SYSTEM
\$2,999**

- LEASE: \$111/MO.
- 4 MB RAM
- 170 MB (17 ms) HARD DRIVE
- 4 EISA EXPANSION SLOTS
- 2 ISA EXPANSION SLOTS
- UPGRADEABLE PROCESSOR
- ACCELERATED LOCAL BUS VIDEO WITH 1 MB VIDEO RAM (UP TO 25 MILLION WINMARKS)
- ULTRASCAN™ 14C MONITOR (14", 1024 X 768, .28mm, NI)



Up to four times faster data transfer than ISA.

You get a 32-bit EISA expansion bus that transfers data at up to 33 megabytes a second. To understand what it does for your computer, drink about eight million cups of coffee.



Guaranteed accountability.

We're the only computer company to guarantee – in writing – compatibility, fast response to your questions, and quick service. Two-thirds of the FORTUNE 500 companies rely on us. So should you.

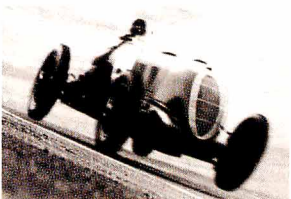


More upgradeability.

It's easy to upgrade all the way to the top 486, the 66 MHz DX2. If you're still power hungry, you'll even be able to add Pentium technology – the next generation from Intel.

**THE NEW DELL 466/T
i486 DX2 66 MHz SYSTEM
\$3,399**

- LEASE: \$126/MO.
- 4 MB RAM
- 230 MB (16 ms) HARD DRIVE
- 128 KB EXTERNAL CACHE
- 8 ISA EXPANSION SLOTS
- UPGRADEABLE PROCESSOR
- ACCELERATED LOCAL BUS VIDEO WITH 1 MB VIDEO RAM (UP TO 29 MILLION WINMARKS)
- ULTRASCAN 15FS MONITOR (15", 1024 X 768, .28mm, NI)



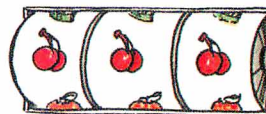
Up to 50% faster system performance.

Good thing you don't have to worry about the highway patrol.



Up to 86% more disk capacity.

Our floor-standing model has a disk capacity of up to three gigabytes. Makes the Astrodome seem positively cramped.



33% more slots.

With eight slots, you can add the network, communication and multiport cards you need for a great low-cost server.

All of the above systems include one floppy drive (3.5" or 5.25"), MS-DOS 5.0 and one-year on-site service.Δ

Each system is custom-built. With 18 different models in our new 486 line — covering 25 MHz, 33 MHz, 50 MHz, and 66 MHz — you can configure just the system you need. In fact, with our complete line of storage, memory, graphics and connectivity products, we can build over 15,000 different configurations.

MA. The data is quoted from a 40-page report available for purchase through Reliability Ratings (617) 444-5755. Reliability Ratings, the research company, is not affiliated with Dell Computer.

ance Series systems purchased after 7/1/92. For a complete copy, please call our TechFax® line at 1-800-950-1329 or write Dell USA L.P., 9505 Arboretum Blvd., Austin TX 78759-7299. service provided by BancTec Service Corporation. On-site service may not be available in certain remote areas. WINMARKS test results obtained by running WINBENCH ver. 2.5 at 1024 x 768. The Intel Inside logo is n. MS-DOS is a registered trademark and Windows is a trademark of Microsoft Corporation. UNIX is a registered trademark of UNIX System Laboratories, Inc. in the United States and other countries. FORTUNE 500 proprietary interest in the marks and names of others. ©1993 Dell Computer Corporation. All rights reserved.

AW HELL, LET'S RUN UP THE SCORE.

Our New Performance
Series 486 systems have
an up to 50% better
price/performance ratio
than before.
Let the blowout begin.

DELL™

800-365-8811

WHEN CALLING, PLEASE REFERENCE #11E92.

HOURS: 7AM-9PM CT MON-FRI, 8AM-4PM CT SAT, 10AM-3PM CT SUN.

IN CANADA, CALL 800-668-3021. IN MEXICO CITY, 228-7811.

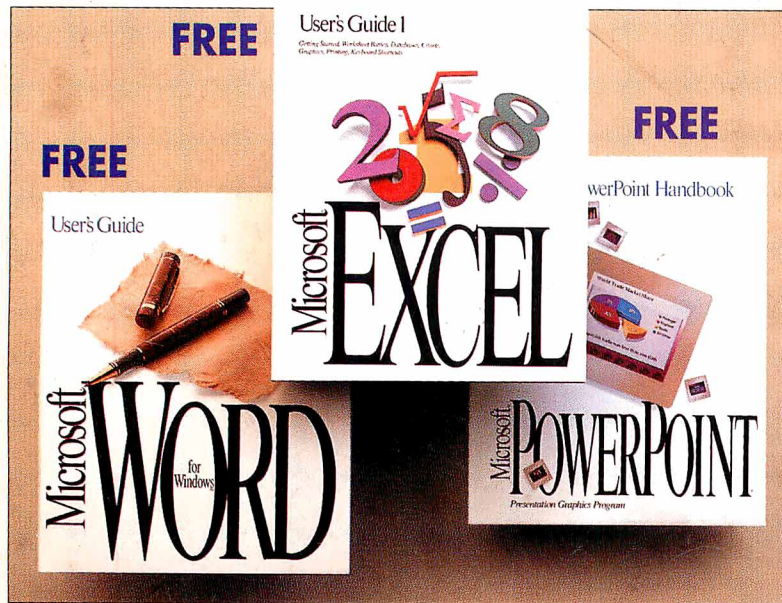


Survey was independently conducted by Reliability Ratings, Needham Corporation and does not endorse its products.

*Guarantees available in USA only for registered owners of Dell Performance Series 486 systems. On-site service available for registered owners of Dell Performance Series 486 systems. Attention: Dell Performance Series 486 systems are registered trademarks of Dell Computer Corporation. 486 and Pentium are trademarks of Intel Corporation. The Time Inc. Magazine Company. Dell disclaims any liability for the accuracy of the information provided.

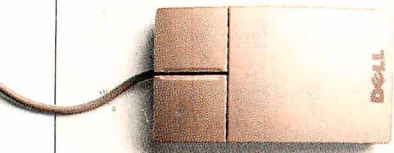
GET \$479 WORTH OF FREE SOFTWARE.

{ WITHOUT BREAKING ANY COPYRIGHT LAWS. }



The best software money can't buy.

When you buy our new Dell 425s/L computer,** we'll set you up with all this great office productivity software. For free, that is. Free, free, free. Any questions?



All the featured software comes pre-loaded. So all you need to make it work is the mouse.



Our new accelerated local bus video gives you blindingly fast video performance – as you'll notice while using the pre-installed Windows™ software.

Painless upgrades. 486 upgrades are easy, all the way to the 66 MHz DX2. You'll even be able to add Intel's new Pentium™ technology.



Guaranteed accountability.

We're the only computer company to guarantee – in writing – compatibility, fast response to your questions, and quick service.*



**THE NEW DELL®
425s/L i486™ SX 25 MHz SYSTEM
\$1,899**

- LEASE*: \$70/MO.
- 4 MB RAM
- 120 MB (17ms) HARD DRIVE
- 3 ISA EXPANSION SLOTS
- UPGRADEABLE PROCESSOR
- SVGA 1024i MONITOR (14" 1024 X 768, .28mm)
- 512 KB VIDEO RAM
- MS-DOS® 5.0
- MICROSOFT® WINDOWS 3.1
- MOUSE
- 2400/9600 FAX MODEM
- COMMUNICATIONS AND FAX SOFTWARE

**OFFER VALID ONLY ON 425s/L SYSTEMS WITH A CONFIGURATION EQUAL TO OR GREATER THAN ABOVE FEATURED CONFIGURATION. OFFER EXPIRES 2/28/93.

DELL™

800-283-1170

WHEN CALLING, PLEASE REFERENCE #11EB3.

HOURS: 7AM-9PM CT MON-FRI, 8AM-4PM CT SAT, 10AM-3PM CT SUN.

IN MEXICO CITY, 228-7811.